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THE CALL TO PUBLIC HEALTH[1]

ONE of the most fruitful sequels of the scientific age has been the new and higher valuation which it places upon ordinary human life.

As long as this present every-day world and this ordinary human life were held, whether by ancients or by medievals, to be merely the prelude to another and a better, any serious struggle for longevity, any earnest plea for health for health's sake, fell upon deaf ears. As long as a sick man or his friends could honestly exclaim in the face of sickness or death, "I know that if my earthly house of this tabernacle be dissolved I have an house not made with hands, eternal, in the heavens," disease and death lost their terrors, and even became almost attractive.

Ideals of this kind, full of hope and rich in encouragement for weary mortals, ought never, and need never, to have been divorced from perfect joy and satisfaction in this present life. It was the refusal to consent to any such separation that brought on the warm springtime of the Renaissance after the winter of the Middle Ages. And it must be reckoned the colossal blunder of theology and ecclesiasticism that in their reaction to the Renaissance they blindly turned their backs upon this world and fixed their gaze upon a distant and an unknown world of which they dreamed much but knew little. It was well that theology should urge man on to the ultimate and the ideal, but it need not, in doing this,

[1] The annual address in medicine, Yale University.

have neglected the near-by and the real. Is it any wonder that under such guidance mankind, while running regardless through the mazes of this world, its eyes glued to the heavens, should have stumbled and fallen over the commonest obstacles; or that some, bruised in falling, should have turned to rend those who had misled them?

The philosopher of the future will surely count as pathological those periods of history in which ordinary life, for whatever reason, was cheaply held; whether by the morbid ambition of kings and generals, or the morbid mentality of theologians and ecclesiastics. Then will it become the glory of the medical profession that nearer than either warriors or churchmen to the sublime teachings of Jesus of Nazareth have been, all through the ages, the theory and practise of physicians, who have always held the life to be more than meat, the body than raiment; who have emphasized that portion of the liturgy which prays, "as well for the body as the soul"; and who have believed that Christ meant what he said when he asserted that he came that mankind might have life, and might have it more abundantly.

The call to life, and to life in this world, is thus the first and fundamental call of the scientific age. And the next is the call to health, *i. e.*, to wholeness or fulness of normal life. It is not merely that we may have life, but that we may have it more abundantly. The first and chief characteristic of science is that it seeks always after nature, after the normal, *i. e.*, the natural, and looks askance upon the abnormal and the super- or the sub-natural. Hence the call of a scientific age for normal, natural life and healthy living; hence its disapproval of disease, hence its disgust with dirt as a cause of disease, and its belief in public health as well as private welfare.

The call to health is also the primal call to individual duty, for the call to life rests not upon us, but upon our forbears. Endowed by our ancestors with living bodies full of a machinery more wonderful and intricate than the works of any other known mechanism, we ought first to realize our responsibility for the care and operation of this precious apparatus. And here again we have to deplore that blind, if not insane, leadership which for so many weary centuries led mankind, not only to an ignorant contempt for the flesh, but to ingenious and hideous forms of mortification of the body, such as fastings, flagellations and various grotesque forms of worship or penance. Happily, we have now a more reasonable regard for the human mechanism, a more general recognition that it is worthy of respect and care. And yet, even to-day our children are taught but little in their schools and less in their colleges about the human body and its proper care and conservation. Physiology, hygiene and sanitation, as elements in the curriculum, are despised by many principals and superintendents of elementary and secondary schools; and, being only rarely subjects required for admission to the higher schools and universities, education is sacrificed to examination, and physiology is pushed aside in the struggle for examination records that will count. The call for public health to be effective must begin not with a clamor for a secretary of public health in the cabinet at Washington, but with a general insistence upon sound and accurate teaching in the public schools of the essentials of physiology and hygiene and the basic principles of sanitation. Out of such teaching would soon grow an interest in the public health, a call for efficient service, and an expenditure for sanitation, which, rightly directed, would become irresistible and lead up logically to federal supervision and assistance.

But the call to public health is not merely

a call to individual welfare; it is also one of the primal social duties. Next after himself, man owes it to his neighbor to be well, and to avoid disease in order that he may impose no burden upon that neighbor. A normal community can only be made up of normal members, and we are but just beginning adequately to recognize that the tuberculous person or the typhoid patient is a menace to the public health. The Germans have given us that excellent phrase *Bacillenträger;* and this, for one disease, we have recently translated as typhoid-carriers. It would be well if we went further, and, instead of speaking as we usually do, merely of "consumptives," if we referred sometimes to these as tuberculosis-carriers. If we could go further yet and refer to syphilis-carriers and other sex-disease carriers, we should do useful service by educating the public to one of the gravest social aspects of public health reform.

The call of the scientific age to public health is nothing less than a summons to mankind to carefully consider and wisely control the whole physical sphere of human life and activity. And this great sphere falls naturally into two hemispheres: namely, that of the human organism on the one hand, and that of the environment of that organism on the other. The general public perceives most easily the environment and its significance to health. Plague and pestilence proceeding from without have long been known and dreaded. The cold of winter, the heat of summer, the lightning stroke, a scarcity of food or drink—all these have long since taught man his dependence on his nearer surroundings. Sunshine and rainfall, dew and frost, seem more remote and mysterious; while planets and fixed stars, the moon and the milky way, have influences so uncertain as to connect them with the unknown and the supernatural—inexplicable human qualities, such as insanity, being easily regarded as moon madness or "lunacy." Of any appreciation of the physical give and take, the chemical and electrical action and reaction, between man and his environment, our predecessors had little or no idea. The story of Newton and the apple still seems to most unscientific minds absurd and impossible. Even to-day it is not in any broad and accurate form that the public conceives of the environmental aspect of public health problems. The idea has gone forth that water should be pure, but most persons still suppose that whatever water flows from city pipes is safe to drink—especially if it is bright and cool. Others, more intelligent, refuse all city water in places known to have impure supplies; yet thoughtlessly drink that very water on cars or steamers departing from such a city, where these have taken on supplies of the impure water. That milk, most ancient and most trusted of all human foods, may carry sickness and death concealed beneath its white and innocent-looking mantle, is an idea which spreads but slowly. That contagion may come, not merely on the wings of the wind, but in a cup of cold water or of milk, in the caress of affection, on the hand of pity stretched out to save, upon the penitential garment, or even upon the sacramental communion cup or the broken bread—these ideas, dimly dreamed of in the past, are among the very corner-stones of sanitary knowledge to-day.

Turning to the other hemisphere of human concern, the organism itself, we enter that province which the medical profession has long made peculiarly its own. The medieval philosophers recognized dimly the true relations of organism and environment, but they fell into the picturesque error of regarding the human body as a kind of miniature copy of the remainder of the universe, and especially of the

heavens. Hence they spoke of man as the microcosm, standing over against, yet reproducing, as it were, the rest of the universe or the macrocosm. It is the glory of the medical profession that it has always had scientific curiosity, that it has insisted upon actually dissecting the human body, mapping out laboriously its real anatomy, puzzling out slowly and painfully its true physiology. It has often been mistaken, but it has seldom refused to observe or to reason. Hippocrates is still admired as the father of medicine, not for his theories, which are now merely historical curiosities; nor for his practise, which was doubtless poor enough; but for his method, which was sound and scientific as well as new; for his insistence on observation and study, especially of the patient; but above all, for his conception of disease as a natural rather than a supernatural phenomenon. Sydenham is still called the English Hippocrates, because he, too, looked upon disease as a natural disturbance of a material mechanism. And that this mechanism possesses—must possess, in order to exist at all—some power of resistance to external conditions is obvious. That some human bodies possess more and some less of this power of resistance is perfectly plain. That the same body may, and actually does, vary in its powers of coping with its surroundings, is also a fact of common human experience. That this "vital resistance" or "vitality" can, within narrow limits, be increased or diminished, is also commonly understood, though seldom popularly formulated—for every one knows the refreshment and reinvigoration of rest, of sleep and of food; the depression and danger of overwork, loss of sleep, starvation, debauchery or poisonings. But the idea that we can artificially and at will secure immunity from virulent diseases, from which there was formerly no escape, dates back less than two centuries: namely, to 1717, and to the letters of Lady Mary Wortley Montagu from Constantinople, telling about inoculation against the smallpox as practised there.

Both conceptions—control of environment and control of the bodies of the people—are indispensable to scientific efforts for public health. The terms "environment," "organism," "vital resistance," "immunity" and the like, are easy to pronounce, easy to repeat. But to the biologist each has had a history and each is full of deep significance. He who would really master the philosophy of life and disease and health must first become a biologist, for the great fact which biology teaches, that man has arisen from the lower animals, helps us to comprehend many human habits and proclivities which would otherwise be hard to understand. Anthropology, especially, and archeology, by showing how man probably first hunted, then tamed, and finally domesticated and dwelt with lower animals, helps us to realize, as our ancestors never dreamed, our lowly origin and our filthy habits. If we are careless of excrements, neglectful of parasites, heedless of food and drink, guided by appetites rather than reason, we do not to-day lay all the blame upon an hypothetical Adam for a natural if not praiseworthy curiosity. We look rather to those long ages of essentially animal behavior, under animal conditions and with animal associations, and marvel not so much at our present carelessness as that we have ever climbed so high. If our dietary of to-day is too rich in protein, and especially in meat, we have perhaps to thank for it those long ages before agriculture had arisen, when meat was the staple food; when the kid or the fatted calf was killed for the guest bidden to meat, as well as for the returning prodigal; when meat and drink went together, and when grace before meat began to be said as it often is to-day—

although the "meat" of to-day may be largely cereals, vegetables and fruit.

We need thus to broaden and deepen our knowledge of the human organism and its evolution before we seek to modify it or its behavior towards the environment. And so, too, in our studies of the environment for health's sake, or for preventive medicine, we must begin with the broadest ideas. For we are here dealing with that other and vastly greater hemisphere of human interest, which, taken together with the human organism, makes up nothing less than the whole known universe. We may even define the environment as that part of the universe not ourselves—a conception which, made dynamic by the interaction of the two reciprocal factors, organism and environment, becomes almost sublime. How delicately the human organism is attuned to its environment we realize when we consider that wonderful rhythm which we call our sleep and our awaking, and that other rhythm of hibernating plants and animals which is the response to seasonal rather than nocturnal darkness. The more intimate relations of climatology and public health have yet to be worked out, but no one can doubt their fundamental importance, and Major Woodruff's main contention, in his interesting book on the effects of tropical light on white men, is certainly correct, as any one knows who has ever felt the tropical sun, or even suffered severely in middle life from sunburn.

The increasing call for health which, as I have shown, has its origin in the conviction that life is worth living, especially if it be normal, healthy life, finds strong support on every hand, but especially in the conservation of human energy; in greater humanitarianism; and in economic and moral efficiency. There is a kind of conservation of human matter and energy as truly as there is of physical matter and force. I hold no brief for vitalism; but our physical human energy is subject to laws of dissipation as surely as is that of the sun, and that man who expends his thought and energy upon himself and his ills, dissipates and loses his stock of energy available for other and better purposes. On the other hand, we must not forget that many invalids and persons in poor health have been heavy contributors to the happiness and welfare of the world. As examples I need only mention the names of Charles Darwin and Robert Louis Stevenson.

The call to health has humanitarian aspects. Is it a light or a small affair to postpone premature death, or to avoid sickness, and thereby postpone or avoid the pain, the sorrow and the weeping of those who would mourn? Is it not a kind of cruelty to allow infected water or milk to carry into happy homes the germs of typhoid or scarlet fever? If a thief in the night should wound and kill, as milk-borne typhoid often does in a family of children, should we not call him cruel? Sickness and deaths from carelessness are not, perhaps, as repugnant or as cruel as those from malice or robbery, but the actual effects upon the family and the social organism are much the same.

As for moral considerations involved in the present-day call to public health, we need only to think of the peevishness or the querulousness of invalidism, which often rises, or falls, into selfishness so gross as to be pathological; of the dyspepsia, with its moral as well as physical torments to patients and their friends; or of those degenerated and perverted human specimens which disease sometimes produces, to show that here also we can no longer attribute to devils what often proceeds from disease, and that the call to health and prevention for morals' sake is loud and urgent.

On the economic side, the call for health

is barely beginning to be appreciated. Sickness and death mean everywhere heavy financial burdens upon the family and the community, and it is now being realized as never before that Emerson's dictum, "the first wealth is health," is strictly true, not only for the individual but for the social individual or community. New light is just now being shed, for example, upon the economic value of one public health measure, viz., a pure water supply, by a verification which one of my students and I have made of a theorem suggested independently, as it seems, by Mr. Mills, the distinguished engineer member of the Massachusetts State Board of Health, and Dr. Reincke, the health officer of Hamburg, Germany, but first publicly formulated and published by the eminent American sanitary engineer, Mr. Allen Hazen. Hazen's theorem asserts that for every death from typhoid fever avoided by the purification of a polluted public water supply, two or three deaths are avoided from other causes. Working under my direction, Mr. Scott MacNutt has recently been able to confirm this surprising theorem, and even to establish it as conservative. We have also gone further than Hazen and discovered what the other causes are from which deaths are thus avoided; and, although our results are not yet all published I may say that conspicuous among these "other causes" are pneumonia, pulmonary tuberculosis, bronchitis and infant mortality. Mr. MacNutt and I have also raised the question, To what is this unexpected result due? But this question we have not yet been able to answer. It may be that the germs of other diseases than typhoid fever are more often waterborne than has hitherto been suspected, so that purification of a polluted water supply causes a cessation of infection; or it may be that polluted water somehow depresses the vital resistance and so permits micro-organisms which might otherwise have been successfully resisted, to gain a fatal foothold; or it may be that both these factors are at work, and that each is partly responsible for the fortunate result. On this problem we are still at work.

The city of Pittsburg is just installing a great municipal filter plant for the purification of its principal water supply, at an expense of upwards of $7,000,000. It is reasonable to estimate that in a year or two this should effect a saving of 100 deaths a year from typhoid fever; for the number of typhoid fever deaths of late years has been 400 or more yearly. Valuing these lives at $5,000 each, as is customary, the saving effected by the purification works should be half a million of dollars worth of human life annually, making the building of the filter a sound and profitable economic as well as a humanitarian measure. But if, as Mr. MacNutt and I have shown, Hazen's theorem is true, then for every 100 deaths saved from typhoid fever, at least 200 will be saved from other causes; which means at least $1,000,000 more saved to the city of Pittsburg annually, of its present waste of human life.

The call to leadership in the public health service is a call to the educated everywhere, but especially to educated physicians. And I would, if I could, impress upon the young men about to claim that title from this ancient university, that it is their duty as well as their privilege to lead a willing public on to higher achievements of public as well as private health. It has long been the glory of the medical profession that its members were primarily naturalists rather than supernaturalists, as the word "physician" itself testifies, for it means "a naturalist." That other cognomen of the profession, "doctor," points the way to another duty, another high and noble function, namely, that of the "teacher." Physicians and

doctors, naturalists and teachers of physic, *i. e.*, of nature—need any one ask for a nobler vocation! But if teachers and students of nature, you must be learners, also, and that not merely of the healing art, but of that other equally important sister art, the art of prevention. The call to public health is a call to preventive as well as to healing medicine; and here under our definitions, you may to-day join hands with such members of the laity as aid in the promotion of health, the prevention of disease; for example, with the sanitary engineer, the sanitary chemist, the sanitary biologist, the physiologist, the statistical expert, and the expert in physical education—for these, too, are naturalists and hence physicists, *i. e.*, in the strict sense, physicians.

Fortunately, the call of the age to public health comes to us with the new knowledge in pathology. We now know as never before that in that portion of the universe not ourselves lie many, perhaps most, of the sources of our sickness. The call to health is thus largely a call to beware of our environment, *i. e.*, of the things about us, and here at last we can agree with the monastics. But again the unwisdom of a philosophy which bids us turn our eyes heavenward and neglect things close at hand becomes painfully manifest.

Nor is the newer doctrine merely an enlightened selfishness; it is practical altruism, also, for it recognizes the solidarity of mankind and the fact that whoever purifies drinking water or dirty milk from the germs of disease; whoever promotes temperance or avoids sickness in himself or his household, lifts a burden from other men's shoulders and increases the potential efficiency of some other of those units of which the whole body politic is made up. The call of the age to health is a call to sacrifice and to service, both personal and public; and the call to service has been the deepening undertone of the call to humanism, all along the ages. Sophocles, in his day, urged it upon the Athenians, and Œdipus seizes upon public service for his final passionate appeal to the prophet Teiresias for aid against the plague with which the land was cursed: "For in thee is our hope; and a man's noblest task is to help others, by his best means and powers." Our modern cynics may smile at the inconsistency of an age like our own which is constantly preaching the gospel of service and efficiency, and yet suffers grievously from bad domestic service and bad municipal service; but physicians, at least, do not need to be told that it is one thing to prescribe for a patient and quite another to persuade that patient to follow good advice.

Let us next inquire what responses these various calls of the scientific age for life and health have hitherto awakened or are now awakening, and what should be the attitude of the young men just graduating in medicine toward the new movement. The first, though perhaps in part unconscious, responses were those of the eighteenth century reformers, Voltaire, Beccaria, Turgot and others, in France, and Lady Montagu, John Howard, Captain Cook the navigator, and above all Edward Jenner, in England. The eighteenth century, and especially that portion of it in which Mr. John Morley has happily located the scientific renascence, consciously or unconsciously felt the beginnings of the new movement; and in Voltaire's "Man of Calas," in Captain Cook's famous second voyage, in John Howard's travels and revelations, in Lady Montagu's introduction of inoculation and Jenner's work on vaccination for smallpox, began to shake off medieval ideas of life, death, health, dirt and disease, and to prepare for Virchow and Darwin, and Pasteur and Koch and von Behring in the nineteenth century. As one of the foremost responses of the

nineteenth century we must put that perhaps unconscious one which began, we are told, exactly a century ago, and which is known as the temperance movement. Under whatever form, and however fanatical or foolish, or at times even harmful, he may have been, the temperance or prohibitionist agitator has always urged the salvation of the body as well as the soul; the conservation of family life threatened with ruin by drunkenness; the social significance and the economic importance of temperance, and even abstinence, as regards alcohol.

I make this acknowledgment with special pleasure, because on another occasion, and because of the fanatical and harmful subjection of public school education in physiology to the so-called "scientific temperance" propaganda, I have publicly and severely criticized and even castigated that form of the movement. Of that criticism I have absolutely nothing to retract; but I here gladly give high honor to the authors and promoters of the temperance movement in its broader features, for having done the age a great service by urging its attention to the welfare of the body, and insisting that the salvation of the body from drunkenness and the horrible sequelæ of alcoholism is not only possible, but also worth while. The use of alcoholic liquors, oddly enough, had already served sanitary science well, much earlier, since lead poisoning appears to have been first detected by a physician, Sir George Baker, among drinkers of Devonshire cider—the cider mills of Devonshire in the eighteenth century having had lead connections, easily soluble in the acids of apple juice.

Of contemporary response nothing has equalled, or even approached in breadth and significance, the anti-tuberculosis movement. Begun by laymen—as were also the earliest boards of health—this movement has become especially important because of the cooperation in the campaign, on an equal footing, of medical men and laymen. In this anti-tuberculosis movement the medical profession has for the first time, as far as I know, thrown off the ancient mantle of professional exclusiveness in dealing with a medical problem, and invited the public to share with themselves all of their professional knowledge—and ignorance. This step seems to me of extreme importance and sure to prove of lasting honor to the profession. The clergy long since led the way and shared their knowledge and their aspirations with the people; the medical profession has now taken the same democratic and inevitable step, and it only remains for teachers and practitioners of the law to follow suit. Perhaps when they have done this our legislatures will be improved and our cities better governed. For better or worse, America has embraced democracy, and in a democracy any professionalism that smacks of aristocracy or unnecessary secrecy, is out of place.

Official recognition of the call to public health began in the nineteenth century with the factory acts, the health of towns' commission, and the organization of state and local boards of health. State medicine has powerfully responded to the call in England and of late in Germany, but in our own land more slowly. The national board of health of the United States had an honorable if brief existence about a quarter of a century ago. The state board of health of Massachusetts, reorganized upon a thoroughly modern plan in 1886, has won great and deserved distinction, and still maintains its leadership among all our state boards. Michigan and Connecticut, and especially Ohio, New York and Pennsylvania, and very lately Virginia, have followed after. In Massachusetts, and to some extent in the other states, investigation has been added to administration as a state function, and with the happiest results.

Here and there municipal boards of health have responded heartily to the call to public health, but as a rule these boards are poorly made up, poorly officered and little respected. Here, then, is a place where the young physician can often take hold and help to forward the cause. He can urge and work for the establishment and support of a good chemical, bacteriological and diagnostic laboratory; he can report his cases of infectious disease promptly; he can appear before the local medical society, or the local academy of arts and sciences, or the local natural history society, and urge upon its members the importance of clean streets, pure water, fresh and clean milk, tenement house inspection, and the like. He can even write to the newspapers, without fear of any breach of professional ethics, advocating these reforms. The medical man who advertises himself is more obnoxious to-day than ever before; but the man who writes to the papers and has something vital to say, even if he makes himself known and talked about thereby, is rightly held to be doing good. In this connection a word should be added of hearty appreciation of the splendid work done by the Harvard Medical School in its free courses of popular lectures on medical subjects, given during the last two winters before large and appreciative audiences in Boston.

The call to health and preventive medicine has met with no quicker or heartier response anywhere than from workers in applied science and technology—engineers, chemists, biologists, bacteriologists and statisticians. The appointment by the governor of Massachusetts of Mr. Hiram F. Mills, a distinguished hydraulic engineer, to a position on the state board of health in 1886, and his election by his colleagues to the chairmanship of the committee on water supply and sewerage, marked a new epoch in public health science, and was a direct response to the call for expert leadership in the hygiene and sanitation of the environment. The establishment of an engineering division of the work of the board naturally followed; and this example has been imitated with success by other boards, notably those of Connecticut, Ohio, Pennsylvania and New York. The fact is, as I have shown on another occasion, that full knowledge of all the numerous aspects of public health science and preventive medicine has become impossible for any one man, or any one kind of man, so that various kinds of experts must to-day cooperate. The great municipal filtration works, which to-day purify our rivers, are not built or operated or even thoroughly understood by medical men. They are built and operated by engineers, tested and proved by bacteriologists, and paid for by the people.

The medical departments of the army and the navy are making their own responses to the call to public health. The magnificent work of those self-sacrificing officers of the army medical corps which gave us our present ideas of yellow fever control, has shed renown upon the whole American medical profession. And the brilliant achievements of the United States Public Health and Marine Hospital Service, in applying these ideas and discoveries to the actual suppression of the great yellow fever epidemic of 1905, have added honorably and materially to that renown. The more recent and remarkably efficient work of this same branch of the federal service in controlling the alarming outbreak of bubonic plague on the Pacific coast deserves the highest praise. Both achievements, especially when added to the orderly, extensive and fruitful investigations constantly going forward in the Hygienic Laboratory of the Public Health and Marine Hospital Service, ought to make the fact better known than it yet is, that we already possess the very large and active nucleus of a national board of health, pre-

pared at all times to respond to the call of states or cities in sanitary distress or in need of sound advice on public health matters. When to all these responses and successes we add that greatest of all modern sanitary achievements, the making habitable of the Isthmian Canal Zone, largely through the genius of one man, we need not be surprised that the American Medical Association has chosen that man for its next president, namely, Colonel William C. Gorgas, medical member of the Isthmian Canal Commission, but a sanitarian rather than an ordinary medical man.

Enough has been said to show the marvelous responses made or making on every hand to the call with which we are dealing. And yet much more might be said. The establishment of the Rockefeller Institute for Medical Research, of the McCormick Institute for Infectious Diseases, of sanitary and engineering research laboratories, of a permanent and well-equipped federal census bureau, the recent proposal of Dr. Ditman, of Columbia University, for the establishment of a school of sanitary science and preventive medicine—all these testify that the call to health is being heard and answered.

The relation of the physician to the public is rapidly changing. He will soon be expected to be as proficient in the art of prevention as in that of healing. He will not be expected to build water works or sewerage systems, or to install systems of street cleaning, or garbage disposal, or heating and ventilation. These will be left, where they belong, with the sanitary engineer. He will not be expected to be an analyst of foods and drugs, or a judge of their purity. Public health work of this kind belongs to the sanitary chemist. He will not usually, though he will occasionally, be a bacteriologist to boards of health, or sanitary testing stations, or municipal water works, or sewage filters. Such work will be done more and more by sanitary biologists. What he will do, will be, first and foremost, to fulfill that most ancient and most honorable function of the medical man and remain the trusted and intimate medical adviser of individuals and of families in sickness and in health. He will not, however, be content with this alone. He will seek, in season and out of season, not merely to cure but still more to prevent disease among individuals, families and communities, by urging higher standards of living; by teaching temperance in all things; by advocating pure water, pure milk, pure food, pure living. If it is in him to be an investigator or a teacher, he will be one or both of these things. If not, he will be a frank and honest, but not a captious, critic; he will mold and reform, if he can not lead, public opinion. And by so doing he will give to his day and his generation noble and useful service; he will respond to the call of the age; he will do his part for the public health; he will uphold greatly the traditions of a great profession.

William T. Sedgwick
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APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE[1]

The aggregate of the appropriations carried in the act is $11,672,106. This does not include an appropriation of $460,000 for the printing and binding of the department, which appears in the appropriation act for sundry civil expenses. There are also permanent appropriations of $3,000,000 for the federal meat inspection and of $528,000 for the Adams fund, both of which are administered by the department, but not included in the act, making a grand total of $15,660,106 for the coming year, and an apparent increase over the previous year of $2,320,814, or about 15 per cent. A large part of this increase, however, is only nominal, as for the present year over

[1] From *The Experiment Station Record.*

$1,000,000 derived from receipts from forest reserves is available, whereas under the terms of the act for 1907–8 subsequent receipts must be turned into the treasury. The real increase carried by the act is distributed through the work of the entire department, but notably larger sums are available for what may be termed its administrative duties, such as the management of the national forests, the pure food and drug inspection, and the campaign against the gipsy moth and cattle tick, as well as for additional buildings and equipment on the forest reserves and for the Weather Bureau.

In the matter of general legislation the act perhaps contains no measures of the large importance of the meat-inspection law or the Nelson amendment, which have been such notable features in previous years, although a number of new lines are provided, and some are of considerable importance. Among these may be mentioned the inauguration of evaporation investigations and of studies of the prevalence and extent of tuberculosis among dairy cattle, the establishment of a standard of cotton grading, the inspection of foods intended for export under certain conditions, and the making of denatured alcohol in small amounts under farm conditions. The sum of $10,000 is appropriated for the testing of plants as to their suitability for paper making, and a like sum is available for an inquiry into the destruction of forests by the production of turpentine and resin and the sources and methods of the industry, and for a report, in cooperation with the Bureau of the Census, upon the production of the naval stores industry.

The president was directed to reserve not to exceed 12,800 acres of the Flathead Indian Reservation in Montana for a permanent national bison range, for a herd of bison to be presented by the American Bison Society, $30,000 being appropriated for payment of these lands and $40,000 for fencing and the erection of buildings. An amendment diverting $5,000 annually from the Morrill and Nelson funds of Cornell University to the Mount Tabor Industrial and Manual Training School was adopted by the senate, but eliminated in conference.

Under the new appropriation act the Weather Bureau receives $1,662,260, an increase of $248,720, the latter chiefly for the erection of additional buildings and the repair and improvement of those now completed. Of this amount $60,000 was appropriated for the erection of a main observatory building at Mount Weather, Va., to replace that destroyed by fire October 23, 1907, and for the erection of a central heating and lighting plant, together with $15,000 for the completion of a physical laboratory and other buildings. The establishment of new stations was authorized and $110,000 was appropriated for sites and buildings, of which $5,000 is to be used for the reestablishment of the station at Pikes Peak. The work of the bureau was increased in scope by the addition of investigations on evaporation. The limit of the cost of maintenance of the bureau printing office was raised from $18,000 to $30,000.

The appropriation of the Bureau of Animal Industry was increased $48,300, making a total of $1,080,860, exclusive of the meat inspection which, as previously stated, is now provided for by permanent law, and also of the emergency appropriation for the eradication of the cattle tick in the south. The latter appropriation was increased from $150,000 to $250,000, of which $25,000 was made immediately available. Specific authority was conferred for the enforcement of the laws of March 3, 1891, relative to the humane treatment of cattle exported to foreign countries, and of June 29, 1906, for the prevention of cruelty to animals during interstate transportation. The investigation of the prevalence and extent of tuberculosis among dairy cattle in the United States was included in the lines of work to be undertaken; while a clause authorizing the expenditure of $5,000 for an investigation of hemorrhagic septicemia, infectious cerebro-spinal meningitis, and malignant catarrh and for the working out, in cooperation with the Minnesota station, of the problem of prevention by means

of antitoxin or preventive vaccines was eliminated.

The Bureau of Plant Industry received an apparent net increase of $289,446, but this includes the boll-weevil work of the bureau, which last year was carried as an emergency appropriation of $150,000. The general work of the bureau was extended to include the establishment of an official standard of cotton classification. A clause making the grain standards fixed by the department the official standards for grading was reported by the house committee, but stricken out on a point of order. The provision for grain inspection was continued on the present basis, except that it was included in the general work of the bureau instead of from a specific appropriation. The work on the prevention of algal and other contaminations of water supplies was restricted to farm water supplies. The appropriation for the introduction of rare seeds and plants from foreign countries was increased $20,000, making $56,000 for this purpose, in addition to the congressional seed distribution, which was continued on the usual basis.

The general policy of the forest service was again the subject of extended discussion. An increase of $1,496,200 was granted, making its total appropriation $3,896,200, by far the largest carried in the act. As has been explained, however, the greater part of this increase is in lieu of the forest receipts. The sum of $600,000, an increase of $100,000, was appropriated for the construction and maintenance of roads, bridges, telephone lines, cabins, fences, and other permanent improvements. A number of additional limitations were imposed restricting the entire appropriation to territory under the jurisdiction of the United States, reducing the limit of cost of buildings on the forest reserves from $1,000 to $500, and limiting traveling expenses to "business directly connected with the forest service and in furtherance of the works, aims, and objects specified and authorized in and by this appropriation."

The provisions of the previous year authorizing the extension of the national forests and the giving of advice to owners of woodlands as to their care were eliminated, but authority to aid other federal bureaus in the performance of their duties in respect to the national forests was granted, and advances of money may hereafter be made to chiefs of field parties for fighting forest fires.

The Bureau of Chemistry received an increase of $128,800, chiefly for additional expenses incident to the enforcement of the National Food and Drug Act. Authority was granted to demonstrate and illustrate the methods for the making of denatured alcohol on a scale suited to the farmer or associations of farmers, and also to investigate the character of the chemical and physical tests which are applied to American food products in foreign countries, and, on request, to inspect such products when intended for export to countries requiring such tests.

The appropriation for the Bureau of Soils was increased to $234,700, a net increase of $27,800. Its work was provided for as at present except for some changes as to the scope of the tobacco investigations.

In the Bureau of Entomology the salary of the entomologist was increased from $3,250 to $4,000. The total appropriation was increased $48,950, making $184,960, of which $10,000 is immediately available. This appropriation, however, includes the boll-weevil investigations which have been carried in an emergency appropriation. In addition, the bureau has charge of the gipsy and brown-tail moth campaign, for which an emergency appropriation of $250,000, an increase of $100,000, was made, the entire appropriation being immediately available. The silk investigations in progress for several years are to be brought to a close.

In connection with the Bureau of Biological Survey it will be recalled that while the customary appropriation of $52,000 was granted last year, the secretary was directed to report to what extent, if any, the work done by the survey was duplicated by any other department of the government, and the practical value of the work to the agricultural interests of the country. This report, according to Chairman Scott of the house committee

on agriculture, "demonstrates clearly that the work of the bureau is not a duplication of any being done elsewhere, and that it is of direct and very great value to agriculture"; and the work of the bureau was accordingly continued with an increase of $10,000 for biological investigations.

The total appropriation for the Office of Experiment Stations, including $720,000 for the stations under the Hatch Act, is $1,034,620, an increase of $21,400. This increase includes $3,400 for statutory salaries and $5,000 for agricultural education through farmers' institutes and agricultural schools, making $10,000 for the latter purpose. For the general maintenance of the Office and the irrigation and drainage investigations the appropriations of this year, $30,000 and $150,000, respectively, were continued. The appropriations for the stations in Alaska, Hawaii and Porto Rico were increased $2,000 in each case to correspond with the increase to the state stations under the Adams Act, and $5,000 was granted for the establishment and maintenance of a station in the island of Guam. This island, embracing about 210 square miles, has a population of about 9,000, chiefly engaged in agriculture of a primitive sort, and it is planned to extend assistance to its inhabitants who are now experiencing great losses from a cocoanut disease recently introduced, which threatens the complete extinction of the industry.

An appropriation of $7,000 was also made to the office for setting up and completing the apparatus formerly used in the nutrition investigations and the preparation for publication of results already obtained. In accordance with the current appropriation act, the respiration calorimeter and accessory apparatus belonging to the government have been brought from Middletown, Conn., to Washington, and it is planned to install them in completed form in the basement of one of the new laboratories of the department.

The Bureau of Statistics received an increase in its general fund for the collection of agricultural statistics of $7,000. Reductions on the statutory roll, chiefly through transfer, made a net gain of $1,700.

To provide for the increase in the general business of the department consequent on that of the several bureaus, additional appropriations were granted of $13,700 for the office of the secretary, $4,900 for the division of accounts, $18,160 for the division of publications, and $5,200 for the library. The chief of the division of accounts was made administrative officer of the fiscal affairs of the department. An increase of $39,200 was also allowed for contingent expenses, of which $25,000 is for the construction of shops, stables, and storage buildings to replace the present structures and $8,000 for rent.

The work of the Office of Public Roads was broadened to permit the furnishing of expert advice on road maintenance and administration, as well as on road building, and the appropriation was increased $17,340. A provision was inserted forbidding the rent or purchase of road-making machinery.

Large as is the aggregate appropriation for the department, it represents only about 1.5 per cent. of the entire federal appropriation and a per capita expenditure of less than 20 cents; and, as has been indicated, much of this sum is in the nature of permanent improvements upon an investment.

COMMANDER PEARY'S EXPEDITION

COMMANDER PEARY, from the steamship *Roosevelt,* at Sydney, N. S., on July 16, addressed to Dr. H. F. Osborn, president of the American Museum of Natural History, the following letter:

We are leaving Sydney to-day for the North. I shall go north across the Gulf of St. Lawrence through the Strait of Belle Isle; along the southern portion of the Labrador coast; to the west coast of Greenland in the vicinity of Godhab; then follow the west coast through Davis Strait and Baffin Bay, and across Melville Bay to Cape York, which, if everything goes well, should be reached about the first of August.

For some ten days I shall be occupied in the region from Cape York (76 degrees north latitude) to Etah (about 79 degrees north latitude), taking on board my Eskimos with their dogs, and hunting walrus for my meat supply.

About the middle of August, after replenishing the coal supply of the *Roosevelt* from the auxil-

iary steamer *Erik*, and putting down a coal depot at Etah, the *Roosevelt* will part company with the *Erik*, turning south for home.

I shall then endeavor to force the *Roosevelt* through Kane Basin, Kennedy Channel and Robeson Channel, to winter quarters at Cape Sheridan on the north coast of Grant Land. I hope to get my ship to Cape Sheridan not later than September 15.

Early in February, 1909, I shall leave the ship with dogs and sledges, in the effort to reach the Pole across the ice of the central Polar Sea.

Returning I shall probably come down upon the northern coast of Greenland, and follow that coast back to the *Roosevelt*, which should be reached about the end of June, 1909.

If the sledging journey has been successful the *Roosevelt* will then force her way south the latter part of July, and I shall hope to get in touch with the world again in September or October of 1909.

Should the effort of the spring of 1909 prove unsuccessful, I have supplies and equipment with which to remain another year, and make a second attempt in February, 1910.

Details of the movements of the expedition (as far as the imperfect communication of the North will permit) can be obtained from my friend, Mr. H. L. Bridgman, secretary and treasurer of the Peary Arctic Club.

SCIENTIFIC NOTES AND NEWS

THE Oklahoma constitution contains a provision making it obligatory upon the legislature to establish a Geological Survey. In pursuance of this provision the first state legislature passed a law placing the survey under the control of a commission consisting of the governor, the state superintendent of public instruction and the president of the State University. The sum of $15,000 was appropriated for the work. The commission met on July 25, and elected as director Dr. Chas. N. Gould, head of the department of geology at the State University of Oklahoma. He was instructed to report as soon as possible on the building stone, road material, and oil and gas of the state. Parties are now in the field investigating these problems.

AMONG the recently elected senators in Italy are G. B. Grassi, professor of comparative anatomy at Rome; A. Carle, professor of surgery at Turin; P. Foa, professor of pathologic anatomy at Turin; G. D. Novara, professor of surgery at Genoa, and G. Paladino, professor of physiology at Naples.

THE president and vice-presidents of the Royal College of Surgeons of England, on behalf of the council, addressed to Mr. Thomas Bryant, F.R.C.S., a past-president of the college, on July 16, a letter congratulating him on attaining the age of 80 years and still retaining perfect health of mind and body.

SUMS have now been received amounting to a total of $225,000 for the Koch endowment, to be applied in the crusade against tuberculosis as Dr. Koch may direct.

THE Cornplanter medal for Iroquois Research administered by the Cayuga County Historical Society, of Auburn, New York, has been awarded to Dr. David Boyle, of Toronto.

DR. ALEXANDER TSCHIRCH, professor of pharmacology at Berlin, has been elected rector of the university.

DR. W. R. WHITNEY has been appointed non-resident professor of chemical research in the Massachusetts Institute of Technology.

PROFESSOR SALVIN-MOORE has resigned the directorship of the Liverpool Cancer Research Committee, and the professorship of experimental cytology in the university.

PRESIDENT GEORGE T. WINSTON, of the North Carolina Agricultural College and Station, has retired with a pension from the Carnegie foundation.

MR. F. G. CLAPP, for a number of years with the United States Geological Survey in the investigation and reports of coal, oil, gas and artesian waters, has resigned in order to take up professional work in geology and allied branches of engineering.

DR. JULIUS HAHN, professor of physics at Vienna, will shortly reach the age of seventy years and will retire from the active duties of his chair.

DR. W. DÖNITZ, head of the scientific department of the Royal Institute for Infectious Diseases in Berlin, has celebrated his seventieth birthday.

DR. EDMUND OTIS HOVEY has returned to the American Museum of Natural History after an absence of three months in the West Indies. The principal points visited by him were the islands of Martinique, St. Vincent, Guadeloupe, Grenada and Barbados, in all of which he made collections for the museum supplementary to those previously obtained by him. He was particularly fortunate in securing photographs showing the changes which have taken place during the last five years in both of the active volcanoes, having camped out on Mt. Pelé for ten days and on La Soufrière for five days. Temperature observations on the fumaroles were made, including pyrometer observations on the high-temperature vents of the summit of the new cone of Pelé, where a heat of 959° F. was found. No dust or débris is being discharged at Pelé, although there is abundant and vigorous steam action. The Soufrière of St. Vincent is absolutely quiet. The bottom of the crater is now occupied by a beautiful lake, which is apparently as large as that for which the volcano was famous before the eruptions of 1902–3. Dr. Hovey also obtained many interesting data regarding the extent of erosion and the advance of vegetation and cultivation in both devastated areas. Mrs. Hovey accompanied him on the expedition, including even the camping out on the volcanoes.

A RECENT letter from Mr. V. Stefánsson, who, with Dr. R. M. Anderson and party, left New York City in April on an expedition to the mouth of the Mackenzie River under the auspices of the American Museum of Natural History and the Geological Survey of Canada, reports the successful arrival of the party at Smith's Landing on the Slave River, from which point they were planning to push on to Macpherson in time to make connections with the mail leaving there about the middle of July.

WORD has been received from Mr. Roy C. Andrews, who is now on the Pacific coast near Victoria, B. C., for the purpose of collecting Cetacean specimens for the American Museum of Natural History, that he has secured a fine skeleton of a humpback whale, together with a complete set of baleen. At the time of writing he had measured, photographed and described twenty-four whales of this species, having at the same time made a careful study of their external and osteological characters with a special view to showing individual variation. There being a scarcity of sulphur-bottom whales at this point, Mr. Andrews was planning to go to Kynquot, on the other side of Vancouver Island, in the hope of obtaining one of these animals, terminating his expedition with a trip to Murderer's Cove, Alaska, where dolphins are reported to be very plentiful.

WE learn from the *Journal of the American Medical Association* that a life-size statue of S. P. Botkin, 1832–1889, was unveiled in the grounds of the Military Medical Academy at St. Petersburg on the eighteenth anniversary of his death, May 25. In the memorial address Sirotinin stated that of the seventy pupils who worked under Botkin's direction more than half have become professors at various universities. Botkin founded in 1869 and maintained the Russian *Archives for Internal Medicine,* and in 1880 founded the *Weekly Clinical Gazette,* better known as *Botkin's Gazette,* which became very popular.

JAMES DUNCAN HAGUE, a well-known consulting engineer and mining expert of New York City, at one time connected with the U. S. Geological Survey, fellow of the American Association for the Advancement of Science and of the American Geological Society, died at his country home at Stockbridge, Mass., on August 3, at the age of seventy-two years.

MR. ARTHUR LISTER, F.R.S., of Leytonstone, the son of J. J. Lister, F.R.S., and the younger brother of Lord Lister, eminent for his work on the Mycetozoa, died on July 19, at the age of seventy-eight years.

MYLIUS ERICHSEN, the Danish explorer, and two companions have perished in a snowstorm, while carrying on explorations on the northeastern coast of Greenland.

SIR JOHN BANKS, an Irish physician, known for his work on nervous diseases, died on July 16, at the age of ninety-seven years.

The Forest Service has arranged for six sub-offices, to be situated in six cities which are centers of interest in forestry. Two of these are at San Francisco and Denver, and one will probably be Portland. It is also expected that offices will be opened in the states of Montana and Utah.

Foreign journals announce that a Society of the Observatories of Mont Blanc has been regularly constituted, with a board of directors largely chosen from the Academy of Sciences, for the more systematic continuation of the work begun by the late M. Janssen and M. Vallot. The society has decided to place the Vallot and Janssen observatories under the direction of M. Vallot. With this object the latter has given his establishment to the society just formed—a purely scientific association—which appeals for members and funds. The secretary is Comte de La Baume-Pluvinel, 9 Rue de La Baume, Paris.

UNIVERSITY AND EDUCATIONAL NEWS

Professor James Douglas has given to the University of Arizona ten thousand dollars as an endowment, the income of which is to be used for the purchase of "instruments of precision and research" in the School of Mines and the Department of Mineralogy.

The Peabody College for Teachers at Nashville, Tennessee, which is at present a department of the University of Nashville, but is soon to be established on a separate foundation by the trustees of the Peabody Education Fund, has, by recent action of its authorities, raised its entrance requirements to the full fourteen units as defined by the Carnegie Foundation. The entrance subjects are arranged in three groups, the first requiring Latin and Greek, the second Latin and modern language, the third Latin or modern languages. In the second and third groups there are many alternatives in language, history and science. Following these entrance groups are three four-year courses, all leading to the degree of bachelor of arts. The work in the freshman and sophomore years is mainly prescribed while that in the junior and senior years is nearly all elective. During the last two years the student must select forty per cent. of his work from the professional courses given in the Department of Education, Psychology and Philosophy. The year is divided into quarters, and the classes meet five times a week, and each student is expected to take three courses. The minimum requirement for graduation is thirty-six courses of five hours each, or a total of one hundred and eighty hours.

We learn from the London *Times* that at a meeting of the governing body of the Imperial College of Science and Technology, held on July 24, a letter from the Royal Commissioners of the Exhibition of 1851 was read, intimating that the commissioners had appropriated the whole of the remaining site of their estate at South Kensington for the purposes of the Imperial College of Science and Technology. The question of the provision of additional buildings and laboratories on the sites granted by the commissioners was under consideration, and it was decided, in the first instance, to proceed at once with the provision of new mining and metallurgical buildings for the Royal School of Mines, and to invite Sir Aston Webb, R.A., to serve as architect to these buildings and of such other buildings as the governing body may determine to erect. The Hon. R. J. Strutt, F.R.S., was appointed additional professor of physics and Mr. S. Herbert Cox, professor of mining. Further, an additional professor of zoology, a professor of metallurgy, and an assistant professor of botany are to be appointed in the near future.

Dr. Charles Oliver Merica has been elected president of the University of Wyoming.

Dr. H. A. Christian has been appointed Hersey professor of the theory and practise of physic at the Harvard Medical School.

At Yale University Louis Doremus Huntoon, M.E., at present assistant professor of mining and metallurgy in the Scientific School, has been promoted to a full professorship; George Surface, Ph.D., of the University of Pennsylvania, has been appointed instructor in geography, and George M. Collwell, Ph.D., instructor in mathematics.

MR. B. E. PORTER, instructor in animal husbandry of the Maryland Agricultural College, has been elected professor of agricultural animal husbandry in the Hawaii Agricultural College.

DR. J. M. READE, formerly fellow in botany in Cornell University and during the past year instructor in botany in the University of Georgia, has been made professor of botany in the latter institution.

DR. HERBERT G. KEPPEL, of Northwestern University, has been elected head of the department of mathematics of the University of Florida.

DR. RUDOLF TOMBO, JR., while continuing in his professional duties, has accepted the secretaryship of the alumni council of Columbia University.

T. SLATER JACKSON, B.A., M.D., C.M., has been reappointed demonstrator in the biological department of McGill University, after an absence of three years, during which he visited the tropical seas of Africa and Asia.

THE following appointments have been made at University College, London: Mr. H. M. Hobart, B.Sc., to the newly created lectureship in electrical design; Mr. R. E. Middleton, to the lectureship in municipal engineering for the session 1908–9; Dr. A. W. Stewart, to the lectureship in stereo-chemistry, for the session 1908–9; Mr. G. C. Mathison, M.B., B.S., to the Sharpey research scholarship in physiology; Mr. W. F. Stanton, to be demonstrator in the department of applied mathematics, and Mr. H. S. Bion, to be demonstrator in the department of geology.

PROFESSOR ADOLF KNESER, of Breslau, has declined a call to a chair of mathematics at Leipzig.

DISCUSSION AND CORRESPONDENCE

THE ANNUAL APPROPRIATION FOR SALARIES OF THE INSTRUCTING STAFF AT BRYN MAWR COLLEGE

TO THE EDITOR OF SCIENCE: The reader of the article on "The Salaries of Professors in American Colleges and Universities" that appeared in SCIENCE, July 24, is led to conclusions that are clearly impossible when considering the data concerning Bryn Mawr College given in Table II. along with the data on "Academic Appointments" that are to be found in the Bryn Mawr College programs. The following calculations for the academic year 1905–6 illustrate this fact:

Grade of Academic Appointment	Number of Appointees in each Grade	Average Salary in each Grade	Annual Expenditure in Salaries in each Grade
Professor	8	$2,500	$20,000
Assoc. Prof.	8	2,000	16,000
Associate	15	1,500	22,500
Therefore	31	received	$58,500
at an average salary of $1,887.09			
President	1	$8,000	8,000
Therefore	32	salaries use	$66,500
Total appropriated for 47 salaries			106,687
Balance for 15 salaries			$40,187
at an average salary of $2,679.13			

According to the program, these 15 remaining members of the staff consisted of 3 lecturers, 9 readers and 3 demonstrators. It follows that in this academic year members of the staff in the higher ranks of professor, associate professor and associate averaged only seven tenths as much salary as members of the staff in the lower ranks of lecturer, reader and demonstrator.

When the data for the academic years 1904–5 and 1906–7 are treated in the same way, it is found that average salaries in the higher ranks mentioned were $1,879.31 and $1,983.33, respectively, while the average salaries in the lower ranks were $2,454.83 and $2,177.05. In the first of these years the staff numbered 48, and in the second, 49. The other years to which the figures in your table might have referred are 1902–3, 1903–4 and 1907–8, but these years are excluded because the instructing staffs, according to the college programs, numbered 50, 51 and 54, respectively, while the number in your table is 47.

Only two assumptions have been used in making the calculations given above. The first is that the president receives $8,000. It will be clear to you that if this assumption involves an error of $2,000, more or less, this does not have any very great effect on the conclusions. The other assumption is that

the $106,687 given as "The Annual Appropriation for Salaries of Instructing Staff" is actually spent for the salaries of the instructing staff.

The absurdity of the conclusions raises the question of what is meant by "The Annual Appropriation for Salaries of Instructing Staff," which has been used as the basis of classification of the American colleges and universities. One would naturally think that it means the money spent on the salaries mentioned. If it does mean this, it is clear that Bryn Mawr College has received too advanced a position in the classification.

With great latitude allowed, the phrase might perhaps be interpreted as meaning money available for salaries though not necessarily so spent. This interpretation is particularly improbable in the case of Bryn Mawr College. Its alumnæ have been trying during the last few years to obtain gifts of money from the friends of the college for an endowment fund, the interest on which is to be used to increase the salaries of the professors. In order to retain the older and better known members of the faculty in spite of offers from other institutions, the alumnæ wish to have the salary of a professor raised from $2,500, which has been the salary attaching to that grade, to $3,000. They have already accumulated nearly $100,000 toward this fund. If in the foregoing calculation we insert $3,000 in the place of $2,500 as the salary of a professor, it appears that an annual appropriation of $106,687, if available, would not only have met this increased demand but would also have sufficed to have given the instructors of lower ranks, namely, lecturers, readers and demonstrators, an average salary of $2,412.46. Making similar changes in the two other academic years considered, this average salary could have been $2,260.38 and $1,871.50. The calculation leaves no doubt that Bryn Mawr College if it had $106,687 actually available annually for the salaries of the instructing staff would be able, unaided, to raise the salaries as the alumnæ desire.

David Wilbur Horn,
Associate and Associate Professor of Chemistry in Bryn Mawr College, 1901–7

AIR-SHIPS, PAST AND PRESENT

To the Editor of Science: In a review of "Air-ships, Past and Present" presented in Science, July 3, 1908, pp. 20–21, I notice that O. Chanute, the reviewer, gives 21,100 feet as the greatest altitude above the earth's surface heretofore attained by kites.

I do not know whether this statement was made in ignorance of the Weather Bureau kite flight of October 3 last, or not; but in any case you may wish to note in your journal, if not already there recorded, the following facts:

On October 3, 1907, one of the international dates for scientific kite flights, the Weather Bureau observers at Mt. Weather, Va., succeeded in raising a meteorograph to an altitude of 23,110 feet above mean sea level by means of kites. At that altitude the wind was WNW, the temperature —5.4° F. For the flight 37,300 feet of piano wire was used and the number of kites required to lift were eight having a total lifting surface of 505 square feet.

Cleveland Abbe, Jr.

SCIENTIFIC BOOKS

Heredity. By J. Arthur Thomson, Regius Professor of Natural History in the University of Aberdeen. New York, G. P. Putnam's Sons. 1908.

So much interest is now concentrating on the problems of heredity as a result of the abundant and important observations that have been carried on in recent years, following the leads of Mendel, DeVries and Galton, that a critical estimate of our present knowledge of the phenomena of inheritance can not fail to be of interest. Such an estimate Professor Thomson endeavors to give in the volume before us, which the author speaks of as an "introduction to the study of heredity," and which, it may be said at once, is a book well worth careful reading, bringing together as it does in a concise form the results of observations widely scattered in scientific periodicals, not always readily accessible and all more or less deterrent to the layman.

The author has endeavored to approach his subject *sine irâ et studio* and to a large extent he has been successful. He avowedly sails,

however, under the flag of Weismannism and nails this flag firmly to the mast, refusing to believe, for example, that any explanation of the regeneration of a *Stentor* or a *Hydra* is possible "apart from the postulate of diffusely distributed 'specific units.'" True, he admits that determinants are "scientific fictions," that they are elements of a "symbolic notation" to be discarded so soon as it is shown to be inconsistent with demonstrable facts, but nevertheless he believes that heredity can be discussed and understood at present only on the assumption of the existence of such material bases of inheritance. But that such a concept is merely carrying the difficulty a step farther back is not considered. The determinants are living entities which grow and reproduce, vary and inherit, even as the cell, and, admitting their existence, we are still far from understanding the ultimate causes of the phenomena of heredity. Indeed, it would seem that the problem of heredity and the problem of life are fundamentally the same, or, at all events, that the solution of the one is dependent on that of the other, for, as Professor Thomson puts it, "the organism and its inheritance are, to begin with, one and the same." But a complete comprehension of the ultimate causes of life, of organization and of inheritance is yet of the future, and it must be admitted that the concept of determinants or specific material units furnishes a convenient "notation" for the discussion of certain phenomena of inheritance; it is not, however, the only concept possible, and it is to be regretted that its dominance in Professor Thomson has rendered him somewhat intolerant of epigenetic possibilities.

The book starts with definitions of heredity and inheritance, and proceeds to discuss the physical basis of inheritance, the germ cells, their maturation and fertilization. Then follows a discussion of variation, which is classified as fluctuating and discontinuous, a consideration of the latter leading to a criticism of the mutation theory of DeVries; and, similarly, a chapter is devoted to modes of inheritance, which are classified as blended, exclusive (preponderant, although discarded by the author, seems preferable) and particulate. A remarkably sane discussion of reversion follows, the phenomenon being regarded as of rare occurrence, and many of the cases usually referred to it, such, for instance, as the classic one of supernumerary mammæ, are properly excluded. Reversion is defined as including "all cases where, *through inheritance,* there appears in an individual some character or combination of characters which was not expressed in his immediate lineage, but which had occurred in a remoter but not hypothetical ancestor." With a discussion of telegony and maternal impressions, in which again a thoroughly judicious position is taken, and of the inheritance of acquired characters, concerning which the author's Weismannian convictions determine his position, the exposition of what may be termed the illustrative side of the question is concluded, this having occupied approximately one half of the volume.

A most interesting chapter on heredity and disease precedes one on the statistical study of inheritance, and this is followed by a consideration of the results of experimental studies, in which the Mendelian phenomena are discussed. Then follows an account of the theories of heredity, a relatively brief historical review preceding an exposition of Weismann's theories, and after a consideration of heredity and sex and of sex determination, the book concludes with a most suggestive and admirably expressed discussion of the social aspects of the question.

This summary of the contents of the book will indicate the breadth of its scope and the thoroughness with which its subject is discussed. Criticism is, of course, possible, but the errors against which it must be directed are rather of omission than of commission. One would have wished, for instance, a fuller statement of the method and results of the statistical study of heredity, the chapter upon that topic being principally a discussion of Galton's views of inheritance, and space for the enlargement of the chapter could have been obtained by a curtailment of that devoted to Weismann's theories, which have already been made familiar to English readers. A

consideration of the results of Morgan and Seeliger, and especially of those of Godlewski, would probably have modified the deduction drawn from Boveri's experiments on the fertilization of non-nucleated fragments of echinoderm eggs, as to the all-importance of the chromosomes in inheritance; and, similarly, no notice is taken of the work of Herbst and Doncaster, whose results antagonize those of Vernon on the influence of overripeness of the germ cells in the determination of the two parents in inheritance. But these and the few other imperfections that might be noticed do not interfere materially with the value of the book. It fulfils its purpose as an "introduction to the study of heredity" excellently well, it is rich in illustrative facts and judicious criticism, and is written in a style which is clear, consecutive, forcible and, at times, even picturesque.

It should be added that there is a good index, a bibliography of representative papers on heredity occupying forty-eight pages, and a very useful subject-index to the bibliography.

J. P. McM.

Mind in the Making. By Edgar James Swift, Professor of Psychology and Pedagogy in Washington University, St. Louis. New York, Charles Scribner's Sons. 1908. Pp. viii + 329.

Professor Swift's book is of real value to both investigators in educational psychology and students of college grade. The former class will find in it data of importance on the youthful delinquencies of people whose adult lives were decidedly above the average in conventional and probably in real morality, on the variability of intellectual achievement and on the influence of the knowledge of one or more foreign languages upon the learning of another. This last set of facts is especially important because it represents the cooperation of a teacher in service (Mr. William W. Hall, of the Yeatman High School in St. Louis) with a psychologist in an experiment conducted under class-room conditions. Such school-room experiments, comparable to the scientific work now being done in hospitals or on experimental farms, are a most hopeful sign that education is to be rationalized by science.

The data reported by Professor Swift support the conclusions: (1) that youthful irregularities in the way of theft, intemperance and the like are distributed amongst individuals continuously from a condition of complete lawlessness to that of complete "goody-goodyness," (2) that their presence then is consistent with a higher than average restraint from crime in adult life; (3) that individual differences in intellectual capacities are so great as to be of great practical importance, and (4) that the influence of training with one foreign language upon efficiency in learning another does not consist, to any considerable extent, in a subtle discipline of general mental functions. These conclusions, though doubtless acceptable to observant and matter-of-fact thinkers, have all been contradicted by theorists concerning education and by the practises recommended by leaders in educational administration.

Competent students of education in college classes and amongst teachers in service will profit by the study of these data and those repeated from Professor Swift's more familiar researches in the psychology of learning. For such the book contains also a descriptive account, with illustrative cases, of the influence of defects in vision, chorea, hysteria and the like upon education, a review of certain aspects of brain anatomy and physiology, a critique of the rigidity and narrowness of present curricula and methods of teaching, and a chapter on the nature of the educative process. All of these should be very useful.

The influence of the report of cases of eminent men and women who did not succeed in schools is more doubtful. It tends, probably without the author's desire, to give the impression that failure to achieve in school is a sign of success out of school and even that failure in early life is a sign of success later. The discussion of the criminal tendencies of boys may also, if taken too naïvely, lead to the expectation that juvenile delinquency is *per se* a healthy stage in a desirable

mental growth. Professor Swift, if I understand him, accepts neither of these conclusions, but he does not clearly deny them. Nor does he make clear the very complicated states of affairs of which the data given are but one aspect.

Concerning some of the conclusions which Professor Swift does definitely accept (such as: "*Every young child must be regarded as a potential genius,*" "*It is doubtful whether in three fourths of the cases criminal tendencies are anything else than a convenient name with which to cover our social sins and failures in education,*" "*Progress* [in the course of practise] *is never steady, but always by leaps*"), it must be noted that other intelligent investigators possessed of the same facts as the author would still not proceed to his conclusions. The ambiguities of units of mental measurement and the complexities of selective influences play too large a rôle in almost all our studies of human nature to leave any one's work exempt from revision and amendment.

The book is interesting throughout, partly because of the selection of topics and partly because the author possesses the admirable quality of writing to produce reactions in others rather than to express his own thoughts. The lack of an index should be remedied, especially since the book is a collection of essays whose separate titles can not at all adequately describe their contents.

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BOTANICAL NOTES

RECENT SYSTEMATIC PUBLICATIONS

THE fourth part of Dr. A. J. Grout's "Mosses with Hand-lens and Microscope" appeared late in April of the present year. It covers pages 247 to 318, and includes the completion of the family *Leskeaceae* and about half of the *Hypnaceae*. Twenty full-page plates, mostly from the Bryologia Europaea and Sullivant's Icones Muscorum, and thirty-two cuts serve to illustrate the text. The announcement is made that the closing part (V.) will be issued some time next year (1909). This closing part will complete the family *Hypnaceae,* and include analytical keys to sterile mosses, a list of errata, and a complete index. When the whole work is finished it will be a most useful addition to American bryological literature, and an indispensable aid to the beginner in the study of mosses. The fine quality of paper and the clear type and good presswork add much to the pleasure one experiences in using the book.

The problem of introducing the student to the work of identifying the plants about him is one which has puzzled botanical teachers not a little, especially since the introduction of laboratory studies has left little time for the old-fashioned preparation by the study of some such text-book as the old Gray's "Lessons" of our boyhood days. When this was used the pupil had nothing to do but to get ready for field work and the "classification" of flowering plants. That was all there was in botany. We had to run over the book in order to know how to "classify" the spring flowers when they appeared. We had to know the meaning of such words as cordate, ovate, spatulate, serrate, dentate, crenate, sepal, petal, introrse, extrorse, hypogynous, epigynous, dehiscent, indehiscent, orthotropous, anatropous, albuminous, exalbuminous, etc., for these were in constant use in the keys to the families and genera, and the descriptions of all botanical groups from divisions and classes to species and varieties. Thus long ago; but now-a-days after a longer or shorter course in laboratory botany where he has learned something of the evolution of the higher plants from the lower, he is sent to the fields with no previous instruction in the terminology of plant structures. He is told to "dig out" the identifications of the plants he finds by the aid of some manual of systematic botany. And it must be confessed, it is often pretty hard digging. The keys and descriptions are so technical as to be difficult of understanding, while the number of species described in the manual is so great as to bewilder and confuse the would-be botanist. Hence has arisen the demand for simple, local floras. By the use of non-technical descriptions it has been found

possible to designate the plants of a limited region so that all of the species may be recognized. This is what has been done by Professor Dr. Clements and his colleagues in the University of Minnesota—Dr. C. O. Rosendahl and Dr. F. K. Butters—in their "Guide to the Spring Flowers of Minnesota." Here by the time limitation, added to the areal limitation, the authors make it possible to readily distinguish practically all of the higher plants their students will find. Keys are very freely used, in fact the booklet is little more than a collection of keys, first to the families, then to the genera, and last to the species. Etymologies are freely given, and every name has its accent correctly indicated. It must prove to be of the greatest use to the pupils in botany classes in all grades of Minnesota schools.

About a year and a half ago Roland M. Harper published an instructive paper in the Annals of the New York Academy of Sciences (Vol. XVII., part 1) entitled "A Phytogeographical Sketch of the Altamaha Grit Region of the Coastal Plain of Georgia." With the index which has now been added it constitutes a stout pamphlet of 436 pages, and 28 full-page plates of reproductions of photographs. A geological map of Georgia showing especially the coastal plain region, including the Altamaha Grit, and seventeen diagrams in the text serve to further illustrate the paper. From map and text we learn that the Altamaha Grit covers about 11,000 square miles in southern Georgia, stretching in a belt of irregular width from the Savannah River southwestwardly to the southwestern corner of the state. Originally the region was covered with open forests in which there was little shade, a condition favoring the growth of shrubby and herbaceous vegetation. The number of species of flowering plants and ferns is given as 739, of which 53 are trees and 107 shrubs and woody vines. The larger trees (with trunks one to three feet in diameter) are *Nyssa uniflora, Persea pubescens, Gordonia lasianthus, Liquidamber styraciflua, Liriodendron tulipifera, Magnolia grandiflora, M. glauca, Quercus alba, Q. michauxii, Q. lyrata, Q. phellos, Hicoria aquatica, Taxodium distichum, T. imbricarium, Pinus palustris, P. elliottii, P. taeda, P. serotina, P. glabra.* Among the genera of arborescent species that are notably absent from the region are *Tilia, Celtis, Populus, Catalpa, Sassafras, Negundo, Platanus* and *Fagus.* Other notable absentees are *Monarda, Rosa, Ranunculus, Polygonum, Trillium, Adiantum* and *Phegopteris.* The paper will repay careful reading and study.

THE DEVELOPMENT OF A GREAT JOURNAL

The few living botanists who saw the beginnings of the *Botanical Gazette* in 1875 have watched its later development with increasing interest and gratification. Appearing as a thin four-page, rather badly printed sheet, of poor paper, and bearing the name of *The Botanical Bulletin,* its beginnings were anything but promising. Yet there was something in it that won it friends from the beginning, in spite of the fact that it was issued by a practically unknown young man, in a little town in the Mississippi Valley, nearly a thousand miles from any considerable botanical library or collection of plants. It was not profound, and no important discoveries were announced in its pages. It was, however, an honest effort to tell truthfully and simply some things that the editor and his friends had seen in the vegetation about them. It made no pretense to being anything more than a little journal of little notes. And it fulfilled this mission so well that it made a distinct place for itself, and as the years went on it enlarged its field, grew in size, and finally came to be the one indispensable journal for every American botanist. It is not necessary to relate the varying fortunes of this journal, nor to tell of its repeated enlargements; most of these are more or less familiar to the present generation of botanists. Within the last few months the *Gazette* has had to take another step in its evolution. In its growth year by year it has added more pages of matter, more text figures and more full-page plates, each of which has added not only to its value to the reader, but very materially to the expense of its publication. On com-

paring it with the average of five of the leading foreign botanical journals it appears that during the past two years the *Gazette* has been giving 945 pages to their 648, 45 plates to their 12; and 182 text figures to their 122, while the average subscription price of the foreign journals is thirty per cent. higher. Accordingly after consulting with many botanists as to what changes should be made to equalize the *Gazette* with other journals of its rank, the editors announce that since "the pressure for publication is increasing rather than diminishing" they will maintain the 80-page size for each number, however gaining additional space by "a more rigid selection of original papers, a greater compression of these papers in text and illustrations, a franker expression of opinion in reviews, and the abandonment of the department of 'News.'" With these changes the publishers advance the subscription price to seven dollars per year, a step which is amply justified by the fact that the *Gazette* will still cost far less per page and plate than any of the foreign journals of its rank. Botanists everywhere will be glad to know of the growth and development of this American journal, and will wish it the continued success which it has earned so well.

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SPECIAL ARTICLES

AN EXAMINATION OF THE THEOREM OF ALLEN HAZEN THAT FOR EVERY DEATH FROM TYPHOID FEVER AVOIDED BY THE PURIFICATION OF PUBLIC WATER SUPPLIES TWO OR THREE DEATHS ARE AVOIDED FROM OTHER CAUSES[1]

IF Hazen's theorem is true, the purification of polluted water supplies has sanitary and economic consequences much more far reaching than has hitherto been supposed. If, for example, in the city of Pittsburg, purification of the public water supplies by the new municipal filters should, as may reasonably be expected, effect a saving of at least one hundred deaths a year from typhoid fever and, according to the theorem, in addition two or three hundred deaths from other causes, such saving of human life means also the avoidance of a present economic waste of two millions of dollars annually instead of half a million from typhoid fever alone.

Hazen's theorem rests upon the discovery by Hiram F. Mills and others that in several cities purification of the public water supply has been immediately followed by a marked decline in the total death rate, such decline being far greater than that which would have been effected by the decline in typhoid fever mortality alone. It appears to have been first definitely formulated and published by Mr. Hazen in a paper on "The Purification of Water in America," presented to the International Engineering Congress at St. Louis, in 1904. The theorem has not hitherto attracted the attention or consideration which it deserves, and we have therefore critically examined the evidence upon which it rests and, having found the theorem not only correct but conservative, have gone further and undertaken to discover precisely what are those "other causes" of death in which the extraordinary decline referred to takes place.

For these purposes we have made an elaborate statistical study of the influence of the purification of polluted public water supplies in Lowell and Lawrence, Mass., upon the total death rates of those cities, and also upon their death rates from various diseases; comparing the data for each city with those of the other, and of both with similar data for Manchester, N. H., a city of the same class which from various points of view, such as location and population, is remarkably well adapted to serve as a norm. As a result of our studies we have found that the theorem is true not only for the cities mentioned, but also for certain other cities, including Hamburg, Germany, when this city substituted a pure for a polluted water supply in 1893. We find, furthermore, that the decline in total mortality is accounted for to a large extent by the diminished number of typhoid fever deaths, but to a much greater extent by a decline in deaths from other causes; that about eighty per cent. of the decline in general mortality

[1] Preliminary communication.

can be readily accounted for; and that among the "other causes" from which the death rates are diminished *pulmonary tuberculosis, pneumonia* and *infant mortality* are prominent.

Finally, we have raised the questions, To what is this remarkable result of the substitution of pure for polluted water due? Is the marked decline in the total death-rate attributable simply to cessation of infection; or is it due to some enhancement of vital resistance; or is it due to the cooperation of these factors? In other words, must pulmonary tuberculosis, pneumonia, infant mortality, etc., be added to the list of water-borne diseases, or does the use of impure water depress the vital resistance of the human organism?

The complete paper, containing a discussion of these and similar questions, numerous statistical tables, diagrams, etc., will be published in the near future.

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Scott MacNutt

Biological Department,
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THE THIRTY-EIGHTH GENERAL MEETING OF THE AMERICAN CHEMICAL SOCIETY—II.

BIOLOGICAL AND SANITARY CHEMISTRY

Thomas B. Osborne, *Chairman*

The Effect of Pasteurization upon the Development of Ammonia in Milk: W. G. Whitman and H. C. Sherman.

The purpose of this investigation was to follow by accurate quantitative determination the development of ammonia in raw and pasteurized milk as a possible measure of protein decomposition. The ammonia content of raw milk kept at 15° to 20° C. usually increased rather rapidly for two days, more slowly during the third and fourth days, and then decreased somewhat for a few days following, increasing again later if the observations were sufficiently prolonged. A similar slight decrease of ammonia toward the end of the first week was sometimes, but not usually, observed in milk pasteurized at 65°; never in milk pasteurized at 85°, which always showed a continuous increase in ammonia content. In milk obtained under ordinary market conditions in New York City and thereafter kept at 15–20°, pasteurization was usually less efficient in checking the development of ammonia than in checking the production of acid, and this was especially true of the milk pasteurized at the higher temperature (85°) which often developed a relatively large amount of ammonia before becoming sour.

Chemical Evidence of Peptonization in Raw and Pasteurized Milk: Rachel H. Colwell and H. C. Sherman.

An attempt was made to judge roughly of the extent of peptonization from the intensity of the biuret reaction after the removal of coagulable proteins and proteoses. The results indicate that pasteurization at 60° for twenty minutes restrained peptonization to about the same extent that it restrained souring, and had no marked influence upon the development of offensive odors. Pasteurization at higher temperatures (75° and 90°) delayed souring to a much greater extent, had less restraining effect upon peptonization and resulted in the subsequent development of much more offensive odors.

Investigations of Wheat Oil: Joseph S. Chamberlain and Geo. L. Bidwell.

The authors determined the physical properties, the iodine absorption, saponification value and refractive index of the crude fats extracted by ether from wheat germ and from wheat flour. The crude fats were then purified by treatment with acetone. The soluble portions consisting in each case of pure liquid oil were studied in the same way. The results show that the purified oils obtained from wheat germ and wheat flour are much more alike than the crude fats. They think it possible that the usual statement, that these two oils are distinctly different, may not be true and expect to study the question further.

Plant Food removed from Growing Plants by Rain or Dew: J. A. Le Clerc and J. F. Breazeale.

Wheat, barley and other plants were grown in pots in a greenhouse and not subjected to weathering conditions. It was demonstrated that the gradual decrease in the total salt content of these crops from the milk stage until final harvest is not due to a physiological process, as was formerly supposed by many investigators, but to a purely mechanical one. The salts do not recede from the plants to the soil through the stems, but are dissolved and leached out by rain or dew.

Analytical data were also cited to show that the same process takes place in potato, rice and oat plants and also in the leaves of trees.

On the Behavior of Lecithin with Bile Salts and the Occurrence of Lecithin in Bile: J. H. LONG and FRANK GEPHART.

The occurrence of lecithin in bile is still a disputed question. From work on the bile of the polar bear Hammarsten concluded some years ago that lecithin is a normal constituent of the bile of this animal. The evidence was indirect, as the presence of the lecithin was inferred from the recognition of certain decomposition products. Failing to effect a separation ourselves, we have attempted to show the presence of lecithin in ox bile in other ways. In preparing pure bile salts, in this case a mixture of taurocholate and glycocholate of sodium, it was found that they contained about 0.3 per cent. of phosphorus. This observation has been frequently made and is one of the grounds on which the lecithin content is assumed. We have determined the sulphur, the nitrogen, the phosphorus and the optical rotation of these salts, and the results may be best explained by assuming the presence of about 7.5 per cent. of the lecithin body. For various reasons, however, the calculation can not be exact. We have determined the extent of the solvent action of bile salts on lecithin and find that 100 parts of the former will dissolve almost exactly 80 parts of the latter to yield a clear solution. This solvent action is much hastened by the presence of many inorganic salts, but the weight dissolved is not increased. We have found the optical rotation of a mixture made in the above proportions, the results of which justify the figures given some years ago by Ulpiana for the rotation of egg lecithin, assuming that in our mixture the one active body does not interfere with the other. We believe this assumption to be correct, or, in other words, that the solution of the lecithin in the bile salt solution is a physical rather than a chemical phenomenon. We have carried out some experiments to show the extent to which these artificial mixtures of lecithin and bile salts may be separated from each other, and conclude from the results found that there is but little prospect that the very small amount of the lecithin which may occur in bile may be actually separated and identified as such.

Some Experimental Studies on Indigestible Carbohydrates: VICTOR C. MYERS. (From the Sheffield Laboratory of Physiological Chemistry, Yale University.)

The purpose of this investigation was to determine quantitatively the digestibility of Iceland moss, *Cetraria islandica*, in man. In three experiments on two different individuals, the raw *cetraria* carbohydrate was almost completely recovered in the stools. In one experiment in which the material was thoroughly boiled there seemed to be a slight utilization. Two experiments recently made by Mr. MacArthur, in this laboratory, with one of the isolated carbohydrates, lichenin, indicate the possibility of its complete utilization. This is certainly different from what beaker digestions would lead us to expect. It is hoped by further investigation the coming year to finally solve this problem.

The Effect of Phytic Acid and its Salts on Plants: OSWALD SCHREINER and M. X. SULLIVAN.

Wheat seedlings growing in soil were found to affect the fertility of this soil in such a way that the seedling crop of wheat was retarded in growth. Among the products of germination there was found by Patten and Hart's method a small amount of phytic acid or anhydro-oxymethylene diphosphoric acid. Accordingly, this acid and its salt were tested as to their effect on wheat. Phytic acid was found to be toxic to wheat in solutions as weak as five parts per million. Its sodium and potassium salts, on the contrary, were decidedly beneficial. The toxicity of the free acid is greater than the toxicity of phosphoric acid containing the same amount of P_2O_5. The increase in transpiration and green weight in solutions of the potassium and sodium phytinate is about the same as the increase given by di-potassium and di-sodium phosphate containing the same amount of P_2O_5. Phytic acid and its salts appear to play an important rôle in plant synthesis.

A Study of the Forms of Nitrogen in the Urine of Herbivora receiving Nutrients from a Single Plant Source: E. V. MCCOLLUM and E. B. HART.

Three lots of calves have been fed for more than a year with rations derived from a single plant source. These rations were respectively corn, wheat and oats, and their products. A standard lot received a mixture of the above grains and their products. The object of the experiment is to study biologically the value of proteids from different plants for the nutrition of animals. An extended study is being made of the metabolism of these animals, but most of the data are as yet too incomplete to be reported. Of the total nitrogen digested, the following per cent. was eliminated in the urine:

Corn-fed animal	31.98
Wheat-fed animal	54.86
Oat-fed animal	41.51
Mixture-fed animal	55.97

These figures are the averages for seven days' record for each animal. The form in which the nitrogen appeared in the urine of each of these calves was determined for a period of two days during which the urine and feces were collected quantitatively. The forms estimated were ammonia, urea, uric acid, purin bases, hippuric acid, kreatinin, kreatin and allantoin. The following are the more conspicuous results. (1) The high percentage of urea compared to that of hippuric acid. The urea ranged between 62.05 and 82.41 per cent. and the hippuric acid between 1.26 and 9.05 per cent. of the total nitrogen. Urea was uniformly higher and hippuric acid lower in wheat-fed calves than in the other lots. Corn-fed calves excreted less nitrogen as urea and more as hippuric acid than the other lots. (2) The kreatinin output calculated in terms of the total nitrogen excreted was very much higher in corn-fed calves than in other lots. Averages: for oat lot, 3.69; wheat lot, 3.01; corn lot, 9.08; mixture lot, 4.57; per cent. of the total nitrogen. (3) The total absence of allantoin from the urines of all wheat-fed calves. Allantoin was present in the urine of the other lots in amounts varying from 3.99 to 11.76 per cent. of the total nitrogen.

The Behavior of Alanin in Metabolism: Graham Lusk.

On giving twenty grams of i-alanin to a dog made diabetic by phlorhizin injections, sugar increased in the urine in an amount to indicate an almost complete (93 per cent.) conversion of alanin into dextrose. This coincides with previous experiments by Mandel and Lusk which showed a complete conversion of lactic acid into dextrose within the organism.

On a Globulin from the Egg Yolk of the Spiny Dog-fish: C. A. Alsberg and E. D. Clark.

The yolk does not contain a typical vitelline: but in its stead a globulin free from phosphorus and perhaps iron. This may be due to the fact that the animal is viviparous.

On the Utilization of Inorganic Phosphorus by Animals: E. B. Hart and E. V. McCollum.

This work embraces experiments extending over a period of two years with growing pigs. The results clearly indicate that inorganic phosphates, such as bone ash, finely ground rock phosphate, or precipitated calcium phosphate—a mixture of di- and tri-calcium phosphates—can be used by these animals where rations containing insufficient phosphorus are being fed. Young animals of forty pounds weight, receiving inorganic phosphate, together with other salts as supplementary on a ration very low in mineral constituents, grew to be animals of 280 pounds weight, bore litters of fairly vigorous pigs, which on the same ration completed the cycle back to 80 pounds, while animals on the same ration, less the inorganic phosphate, collapsed in three months with loss of weight and use of limbs. Some of the more important observations made are as follows: (1) Animals on a ration extremely low in phosphorus made as large gains up to 75 to 100 pounds as did animals receiving an abundance of this element. After reaching this point loss of weight began, followed by collapse. (2) When such low phosphorus rations as induced the above symptoms were supplemented with inorganic phosphates, no untoward results appeared. Animals fed a low phosphorus ration, supplemented with inorganic phosphates, made as vigorous a development as others receiving wholly organic phosphorus. (3) Determinations of calcium and phosphorus in the principal organs and tissues of the animals on the low phosphorus ration showed that they maintained their composition normal. The per cent. of ash in the skeletons of pigs on a depleted phosphorus ration was reduced to nearly one half that of pigs which received a normal ration, or the phosphorus-poor ration plus inorganic phosphates. When the animals were starving for phosphorus they drew it from the skeleton, but always removed calcium and phosphorus in the proportions found in tri-calcium phosphate.

The Importance of Digestion in the Utilization of Cane Sugar: Israel S. Kleiner.

The average output of saccharose after intraperitoneal or subcutaneous introduction into dogs under various experimental conditions was found to be 65 per cent. to 75 per cent. in a large number of experiments. The extremes were 37 per cent. and 99 per cent. There is some evidence that the portion not recovered is not all excreted into the intestine, but is metabolized within the body.

Effect of the Ratio of Magnesium to Calcium on the Roots of Seedlings: Burd L. Hartwell and F. R. Pember.

Magnesium nitrate has been found to be toxic to wheat seedlings; the addition of calcium and

potassium has been found to lessen the toxic effect of magnesium salts. The leafy portion of the seedlings appeared normal. The toxicity of the magnesium salts was shown by comparing growths in these solutions with those in distilled water. The toxic effect of magnesium is greater when there is a deficiency in potassium. Lime added to such solutions is beneficial, but is not believed to be a substitute for potassium.

Abstracts have not been received for the following papers:

The Spontaneous Oxidation of Cystein and Cystin: ALBERT P. MATHEWS.

Investigations on Wheat Oil: JOSEPH S. CHAMBERLAIN and GEORGE L. BIDWELL.

Phosphorus Metabolism Experiments: F. C. COOK.

Artificial Digestion with Organic Acids and with Essential Oils: EDWARD GUDEMAN.

Hydrolyses of Carbohydrates with Blood Serums: EDWARD GUDEMAN.

Composition of Cold-stored Poultry: M. E. PENNINGTON.

On Nucleic Acids: P. A. LEVENE.

The Digestibility of Corn Meal: L. H. MERRILL.

INORGANIC CHEMISTRY

PHILIP E. BROWNING, *Chairman*

The Estimation of Potassium in Soils as the Cobalti-Nitrite: W. A. DRUSHEL.

It was first shown by Karl Gilbert, of Tubingen, ten years ago that potassium is quantitatively precipitated by sodium cobalti-nitrite as the double cobalti-nitrite of sodium and potassium, if the mixture is allowed to stand from 10 to 20 hours. Two years later Adie and Wood used the same reagent for the quantitative estimation of potassium, decomposing the precipitate by boiling with dilute sodium hydroxide, and titrating the nitrites with standard potassium permanganate. Their method has been shortened by evaporating the mixture nearly to dryness after adding an excess of sodium cobalti-nitrite, instead of allowing it to stand 10 to 20 hours, and by oxidizing the precipitate after washing well with a sodium chloride solution, directly with dilute, hot, standard permanganate instead of decomposing the precipitate and removing the cobalt. The oxidation is completed by acidulating with dilute H_2SO_4, the excess of permanganate bleached with standard oxalic acid and the solution titrated to color with permanganate. One cubic centimeter of decinormal permanganate is equivalent to .000857 gram K_2O, since the cobalt is reduced from the trivalent to the bivalent condition. For potassium in soils a weighed amount of soil is digested with 20 per cent. HCl; the extract is evaporated to dryness and gently ignited to remove any ammonium chloride and organic matter present. This residue is then extracted with water acidulated with acetic acid. The extract thus obtained is treated with concentrated sodium cobalti-nitrate and the process carried out as previously indicated.

Potassium in Animal Fluids as the Cobalti-nitrite: W. A. DRUSHEL.

For potassium in urine the dried residue from a measured quantity is treated with a 9:1 nitric-sulphuric acid mixture in a covered platinum dish over the steam bath. After the violent oxidation is over the cover is removed, and the solution evaporated to dryness. The residue is then ignited, gently at first and finally at the full heat of the bunsen burner. In the case of protein-containing fluids, as the blood, lymph, serum and milk, it is preferable to oxidize the dried residue with concentrated nitric acid alone over the steam bath. The solution is then evaporated to dryness, gently ignited, moistened with concentrated H_2SO_4, and ignited as in the case of urine. The residue thus obtained contains nothing which might interfere with the cobalti-nitrate method; it is, therefore, dissolved as may be over the steam bath with a little water acidulated with acetic acid, and, without filtering, the solution is treated with an excess of sodium cobalti-nitrite. From this point the process is carried out as described for soils. The cobalti-nitrite method is applicable in the absence of mineral acids and the salts of ammonium, cesium, rubidium and thallium. The method is rapid and for small amounts of potassium compares favorably with the chlorplatinate method if proper care be taken in washing and oxidizing the precipitated potassium sodium cobalti-nitrite, the chief sources of error being the slight solubility of the precipitate (1 part in 25,000 to 30,000 of water) and in its tendency to include traces of sodium cobalti-nitrite. In this work the chlor-platinate method was used as a control.

Electrolytic Determination of Nitric Acid: OWEN S. SHINN.

It was found that by keeping copper in solution, either by the addition of copper sulphate during reduction, or by retarding the speed at which the anode rotates, the nitric acid is completely reduced to ammonia. This may be de-

termined either by distilling or by titrating excess of acid. Results are almost theoretical.

Observations of Columbium: C. W. Balke and E. F. Smith.

This investigation forms an additional chapter in the study of columbium which has for some time been receiving attention in the laboratory of the University of Pennsylvania. It shows that by crystallization of columbium potassium from 35 per cent. hydrofluoric acid titanium may be completely eliminated. A new method for the preparation of columbium pentachloride passing $SnCl_2$ vapors over columbic oxide is described in great detail. The vapor density of the columbid, $CbCl_5$, is also determined. Numerous analyses of it are also given. The atomic weight of columbium, by decomposition of $CbCl_5$ with water, was determined. The value after all corrections was found to be 93.5. A series of columbates of the ratio 1:1—R_2O, Cb_2O_5 was prepared and minutely studied. Columbates of the ratio 4:3 were also investigated chemically and crystallographically. A third series in which the ratio is 7:6, $7K_2O.6Cb_2O_5$, was also investigated. The following percolumbates were obtained: Na_3ClO_8, Pb_3ClO_8, $MgNaClO_8.8H_2O$, $CaKClO_8.4H_2O$, K_3ClO_8, CO_3ClO_8. The double fluorides of columbium received an exhaustive and thorough review. Pertantalates, analogous to percolumbates, were prepared and analyzed.

The Separation of the Alkali Metal in the Electrolytic Way: J. S. Goldbaum and E. F. Smith.

By means of a mercury cathode and rotating silver anode not only have chloride of the alkaline earth and alkali metals (sodium and potassium) been analyzed, but ammonium halides have been successfully and quantitatively determined. The decomposition values of rubidium and cesium halides have been ascertained and sodium has been separated from ammonium potassium rubidium and cesium. Potassium has been separated from cesium and rubidium. Rubidium and cesium have been separated in this way. The time for this has been greatly reduced. The results have been exceedingly accurate. At present lithium halides are receiving attention.

Specific Gravity and Valence: Arthur J. Hopkins.

Meyer's curve of atomic volumes calls for a symmetrical arrangement of the periodic system, a form of which is suggested. The periodicity of the curve is then shown to be due to the item specific gravity alone. The curve for specific volume is shown to have the same character as Meyer's, the characteristics of which entirely disappear when the figures for specific volume are multiplied by volume or, more exactly, by position number on the periodic system suggested. It is shown that the position number is more important than atomic weights in calculations of certain physical properties.

A System of Qualitative Analysis for the Common Elements. V. Detection of the Acidic Constituents: Arthur A. Noyes and Roger D. Gale.

In the process described by the authors all the volatile acids are separated from the basic constituents by distilling the substance with a mixture of 10 c.cm. of 85 per cent. phosphoric acid and 20 c.cm. of water. The distillate is divided into two equal portions, the former being collected in barium hydroxide solution, and the latter in water. The first portion contains the weaker and more volatile acids, H_2CO_3, H_2SO_3, H_2S, HCN, HNO_2, as well as free halogens; the second portion contains the stronger or less volatile acids, HCl, HBr, HI, HSCN, HF and HNO_3. General and special tests for these constituents are applied separately to the two distillates. By adding copper and continuing the distillation of the substance with the concentrated phosphoric acid, sulphates are reduced to sulphurous acid, and this is collected in water as a third distillate and tested for with barium chloride and bromine water. Boric acid is also distilled over by boiling a separate portion of the substance with methyl-alcohol and sulphuric acid, the alcoholic distillate being tested by the addition of hydrochloric acid and turmeric solution.

Certain Organic Acids and Anhydrides as Standards in Alkalimetry, Acidimetry and Iodimetry: Isaac K. Phelps.

The paper is a continuation and extension of my paper with Hubbard on succinic acid as a standard; in that paper ammonium hydroxide with cochineal as an indicator was used; now I show that succinic acid, or anhydride, malonic acid, benzoic acid, phthalic acid or its anhydride may be used with exactness with sodium hydroxide and phenolphthalein as an indicator and that these same acids and anhydrides may be used also as standards in iodimetry.

Abstracts of the following articles have not been received:

The Estimation of Chromic and Vanadic Acids in the Presence of one Another: Graham Edgar.

In how far are we justified in assuming the Homogeneity of the Chemical Elements? B. B. BOLTWOOD.

The Action of Light on Water of Crystallization: RALPH H. MCKEE and ELVIN J. BERKHEISER.

The Estimation of Cerium in the Presence of the Other Rare Earths by Potassium Ferricyanide: PHILIP E. BROWNING and H. E. PALMER.

The Perchlorates of Hydrazine: A. W. BROWNE and J. W. TURRENTINE.

The Electrolysis of Anhydrous Hydronitic Acid: A. W. BROWNE and G. E. F. LUNDELL.

On the Question of the Existence of Lead Suboxide: DAVID WILBUR HORN.

A System of Qualitative Analysis for the Common Elements. IV. Analysis of the Alkaline-Earth and Alkali Groups: WM. C. BRAY.

The Estimation of Vanadium by Permanganate after Reduction by Titanous Sulfate: H. A. NEWTON.

The Action of Bismuth Oxide on Reduced Salts of Vanadium: H. A. NEWTON.

Processes of Differential Oxidation and Reduction Applied to the Estimation of Vanadium, Molybdenum and Iron: GRAHAM EDGAR.

Determination of Arsenic in Insecticides: D. L. RANDALL and F. W. WOODMAN.

The Perchlorates of Hydrazine: A. W. BROWNE and J. W. TURRENTINE.

PHYSICAL CHEMISTRY

FRANK K. CAMERON, *Chairman*

Liquid above the Critical Temperature: W. P. BRADLEY, A. W. BROWNE and C. F. HALE.

The authors, who adhere to the view that liquid does exist above the critical temperature, describe a way in which that liquid can be "seen" in a Cailletet apparatus while temporarily localized by virtue of its greater specific gravity. It forms ripples which flow down the walls of the container, adhering thereto, and accumulating under the unliquefied vapor. Its top may be sharply bounded, though not, of course, by a meniscus. The location of the boundary is marked by the conduct of the ripples as they flow down upon it, and also by that of similar ascending ripples which may be caused by slight evaporation of the liquid, brought about by appropriate increase of volume. These and other phenomena are continuous above and below the critical temperature.

The Relation between the Temperature of Kerosene and the Explosion Pressure of the Supernatant Mixture of Vapor and Air: W. P. BRADLEY and C. F. HALE.

The explosion pressure of the vapor air mixture of two typical samples of kerosene, confined at atmospheric pressure, were measured from the temperature at which explosion first occurred to that at which the mixture was too rich in vapor to explode. Explosion was induced by the electric spark. At the temperature of the Elliot (closed) cup flash point the explosion pressure is already one half the maximum pressure. At that of the Tagliabul (open) cup flash point it is almost equal to the maximum, while in that of the Tagliabul fire point the mixture is rich, so that the explosion pressure is greatly reduced and the danger therefrom is practically over.

Note on the Hydrolytic Dissociation of Nitrobenzene: R. R. RENSHAW.

Attempts have been made to determine the decomposition of nitrobenzene by water at different temperatures and concentrations by the colorimetric estimation of the nitrite formed. A hundredth molar solution is dissociated between 0.003 and 0.004 per cent. at 37°. Equilibrium is only reached after a number of days. The results at higher temperatures in sealed tubes are of no value on account of the alkali dissolved from the glass. This and similar reactions will be studied by the conductivity method.

The Specific Heats of the Elements: J. E. MILLS.

The paper gives a critical summary of the data upon the specific heats of the elements and points out the following conclusions: (1) The specific heats of the elements change rapidly with the temperature, the change being greatest at low temperature and for elements with low atomic weight. (2) It is absolutely hopeless to claim any sort of constancy for the product of the atomic weight of an element and its specific heat at varying temperatures. (3) The value of the atomic heat at the absolute zero is not the same for all substances, but the substances with the larger atomic weight have at that temperature the largest atomic heat. (4) The total energy of a molecule in the liquid condition at its melting point, if its energy at 0° absolute be considered zero, is approximately three times the kinetic energy of the same molecule were it a gas at that temperature. (5) It is suggested that the law of Dulong and Petit is only a special case of an equation similar to the equation for gases, in which the molecular heat at

constant volume, multiplied by the ratio of the specific heats less than one, is equal to 2K where K is the gas constant.

Some Relations at the Critical Temperature: J. E. Mills.

It was shown that if the density of a liquid be plotted against the temperature the line drawn through the density where it varies linearly with the temperature will, if prolonged, cut off on the ordinate line at the absolute zero just twice the distance that it cut off on the ordinate line at the critical temperature, and this line intersects the temperature axis at a point equal to twice the critical temperature. Moreover, the line of mean density of liquid and saturated vapor discovered by Cailletet and Mathias likewise meets the temperature axis at the same point (twice the critical temperature). The critical density is therefore one fourth of the density of the liquid at absolute zero.

The Relation of the Rate of Settling to the Size of Particles in Suspension: E. E. Free.

Most investigators of sedimentation phenomena have worked with very fine powders where the factors effecting the rate of fall are exceedingly complex. This paper describes an attempt to study the much simpler case of the fall of relatively coarse particles. Quartz sand of various sizes was dropped through distilled water in a long tube and the velocity of fall measured between points a meter apart. It is shown on theoretical grounds that for spherical particles the relation of velocity and size of particle is given by the equation $V^2 = Kr$ where K is a constant. Taking the value of K as found for the coarsest particles (which are least likely to be subject to disturbing influences), the theoretical parabola is plotted and it is shown that the points for powders less than .25 mm. in diameter lie far above the curve. That is, the finer powders fall more slowly than would theoretically be expected. This is probably due in part to the action of secondary forces and in part to the fact that finer grains are more angular and do not approach the spherical form so nearly as do the coarser. With the finest powders flocculation comes into play and again increases the rate of fall.

The Aluminum Cell for preventing Underground Electrolysis: F. E. Gallagher.

After a brief discussion on prevention of underground electrolysis, experiments with a cell containing electrodes of aluminum and lead in a sodium acid phosphate solution were described. The length of time a "formed" aluminum electrode is held cathode determines the extent to which a film decays, and therefore the time required to build up a high resistance when such an electrode is again made anode. The effectiveness of an aluminum anode in checking current is less at low impressed voltage. Under continued direct current action both the lead anode and aluminum cathode are attacked in sodium acid phosphate solution. Carbon instead of lead in phosphoric acid solution would prove more serviceable.

The Specific Heat and the Latent Heat of Vaporization of Silicon Tetrabromide: L. Kahlenberg and E. H. Zobel.

The silicon tetrabromide was prepared by passing bromine over heated metallic silicon. The product was freed from excess of bromine by fractional distillation, treatment with metallic mercury, and finally redistilling. The boiling point of the purified product was 148°.7 at 736 mm. pressure. The specific heat between the temperatures of 24° and 144° was found to be 0.10055, and the latent heat of vaporization was found to be 28.86. The method for determining the specific heat was that employed by Berthelot, and the method of Kahlenberg was used in making the determinations of the latent heat of vaporization. The figures obtained are the mean of several determinations that gave closely agreeing results.

Equilibrium in the System Silver Chloride and Pyridine: Louis Kahlenberg and Walter J. Wittich.

There are two distinct crystalline compounds of silver chloride and pyridine, namely, $AgCl.2C_5H_5N$ and $AgCl.C_5H_5N$; these have hitherto been unknown. The former compound is stable between —56° and —22° C. It was obtained in minute crystals that are very unstable at temperatures above —22° C. $AgCl.C_5H_5N$ is stable between —20° and —1° C. The salt forms small needlelike crystals which are more stable than $AgCl.C_5H_5N$. From —1° to 110° C. the solubility of AgCl in pyridine decreases rapidly as the temperature rises. The entire equilibrium curve of the system silver nitrate and pyridine has been established from the freezing-point of pyridine up to 110° C.

The Validity of Faraday's Law at Low Temperatures: Wendell G. Wilcox.

The experiments were made on silver nitrate

solutions in pyridine. The conclusions reached are that the electrochemical equivalent of silver is independent of the temperature and that Faraday's law holds for temperatures as low as —55° C. provided secondary changes taking place at the electrodes are taken into consideration.

Replacement of Heavy Metals in Non-aqueous Solutions by Metallic Calcium: J. H. WALTON, JR. (Preliminary Report.)

A series of experiments have been carried out for the purpose of determining whether or not a strongly metallic substance, such as calcium, is able to replace the heavy metals of salts which are dissolved in non-aqueous solvents. As a typical heavy metal copper was selected, the oleate being the salt used because of its solubility in a large number of solvents. The experiments were carried out by heating the solution at 100° in a sealed tube with a strip of metallic calcium, the surface of which had been scraped until bright. The following solvents were used for the copper oleate: Toluene, xylene, pyridine, carbon tetrachloride, ethylene bromide, turpentine, paraffine oil, lard oil, carbon bisulphide, aniline, nitrobenzene, amyl acetate. The calcium was tarnished, but in no case was it coated with copper. Calcium heated with fused copper oleate at 150° for two hours also did not precipitate copper. A number of similar experiments were carried out in which the following alloys of calcium were heated with solutions of copper oleate in the above solvents: Ca-Zn, Ca-Cd, Ca-Pb, Ca-Sn, Ca-Bi, Ca-Sb, Ca-Al, Ca-Hg. In the case of the alloys containing Pb, Zn and Cd, respectively, replacement of the copper was observed in pyridine solution; with the other alloys this did not happen. This is in accordance with the observations of Sammis, who found that these metals when heated with certain copper oleate solutions precipitate the copper. In the case of the Ca-Pb alloy it was observed that whereas metallic lead causes the precipitation of Cu only on heating at 100°—the Ca-Pb alloy is coated with copper after standing a few minutes at room temperature. The action of the alloys of Ca is being made the subject of further investigation.

The Absorption of Carbon Dioxid by Certain Bases: F. K. CAMERON and W. O. ROBINSON.

The pressure curves of CO_2 over various metal hydroxids at 0° C. up to 5 atmospheres pressure were determined. It is shown that solid bicarbonates of lime, magnesia and ferrous oxide and carbonates of aluminia, ferric oxide and beryllia do not exist under the forenamed conditions.

The Dry Grading of Powders: E. E. FREE.

It is often necessary to grade a powder without wetting it. Bolting cloths are useful for coarser powders, but not for finer. Air elutriation has been used technically to meet this problem and has been used for scientific purposes by Cushman and Hubbard.[1] This paper suggests an improvement of their apparatus, in that the stream of air carrying the suspended powder is introduced into the smallest of a series of percolation jars and passes through them successively in order of increasing size (instead of the reverse). The velocity of the air stream thus decreases from jar to jar and finer and finer powders are deposited in each. The main trouble with this apparatus is due to flocculation of the powder. The finer grains stick to the larger and to the sides of the apparatus and the only fraction which is entirely of the size desired is the last, or finest fraction. The intermediate grades all contain a small amount of finer material. This flocculation is mainly due to water films on the particles and to electrical charges. That due to water is decreased by drying, but this increases the electrical flocculation. The minimum of flocculation is found when air and powder are almost, but not quite, dry.

The Solubility of Basic Copper Carbonate in Solutions of Carbon Dioxide: E. E. FREE.

The investigations detailed in this paper form part of the studies on the effect of copper salts in irrigating waters, which have been in progress for several years at the Arizona Agricultural Experiment Station. It is shown that the compound precipitated from solutions of carbonates and copper salts is of variable composition, but that under the action of carbon dioxide and water for several days it changes to a compound of definite solubility and probably definite composition. The $CuO : CO : H_2O$ ratio (molecular) of this compound is 1.000 : .515 : .603. Its solubility in water is greatly increased by the presence of carbon dioxide. With 1,200 parts of carbon dioxide per million about 35 parts of copper per million dissolve. The solubility in solutions of carbon dioxide is increased by the presence of sodium chloride, sodium sulphate and probably calcium sulphate, and is depressed by the presence of sodium or calcium bicarbonate.

The Constitution of Alum Molecules in Solution: CHAS. L. PARSONS and W. W. EVANS.

Diffusion experiments with iron, aluminum and chromium alums, both with membranes and agar

[1] *J. Amer. Chem. Soc.*, **29**, 589–597 (1907).

agar, showed that the constituents of the molecules of the alums separate from each other readily by diffusion at both 0° and 25°.

The Constitution of Solutions of Iodine in Aqueous Potassium Iodide: Chas. L. Parsons and Geo. A. Perley.

Diffusion experiments with solutions of iodine in aqueous potassium iodide, using membranes or agar agar, show that the potassium iodide and the iodine diffuse independently of each other in both dilute and concentrated solutions.

The Inversion of Cane Sugar by Invertase: C. S. Hudson.

It is shown that in dilute solutions the inversion is a unimolecular reaction, following accurately the logarithmic formula. The real rate can not, however, be measured in a polarimeter unless the solution is made alkaline before each reading, as otherwise the apparent rate of inversion is observed which differs from the real rate by as much as 50 per cent. Henri, Armstrong and others who claim that the actions of invertase and of other enzymes differ from the usual types of catalysis, have measured the apparent rate rather than the real rate. The investigation is being continued and a preliminary notice of it may be found in the July number of the *Journal of the American Chemical Society.*

Abstracts for the following papers have not been received:

Precipitation of Copper from Chloride Solutions by Means of Ferrous Chloride: Gustave Fernekes.

Precipitation of Copper from Chloride Solutions by Means of Ferrous Chloride and its Relation to the Genesis of the Michigan Copper Deposits: Gustave Fernekes.

Equilibrium in the System—Potassium Iodide, Iodine and Ethyl Alcohol: Chas. L. Parsons and Geo. A. Perley.

The Velocity of Reactions in Gases moving through Heated Tubes and the Effect of Catalysis: Irving Langmuir.

An Automatic Regulator for Electric Currents: Irving Langmuir.

On the Mechanism of the Formation of Esters from Alkyl Halides and Salts of Organic Acids: S. F. Acree and F. M. Rogers.

The Dissociation Pressures of Certain Oxides at High Temperature: P. T. Walden.

A Physico-chemical Study of the Phosphoric Acids: G. A. Abbott.

The Use of the Conductivity Method in Testing Nicotin Solutions and Tobacco Extracts: Harris E. Sawyer.

Studies in Electromotive Force: G. N. Lewis.

The Reduction of Cadmium by Mercury and the E.M.F. of Cadmium Amalgams: G. A. Hulett and R. E. DeLury.

Cadmium, Cadmium Sulfate and its Solutions: G. A. Hulett.

Types of Electrolytes: J. Johnston.

The Hydration of Ions: E. W. Washburn.

Negative Viscosity: Frederick H. Getman.

Latent and Specific Heats of Some Fused Salts: H. T. Kalmus.

The Behavior of Colloidal Metals with Immiscible Solvents: W. Lash Miller.

Solutions of Metals in Liquid Ammonia: C. A. Kraus.

Electrolytic Reduction of Permanganate Solutions: J. W. Turrentine.

Mercury Cathodes in Nitric Acid Solutions: J. A. Wilkinson.

On Vapor Pressures: O. F. Tower.

On the Electrolytic Oxidation of Hydrazine Sulfate: J. W. Turrentine.

Action of Ferric Sulfate on Copper: C. G. Schluederberg.

Experiments with Halogen Carriers: C. G. Schluederberg.

The Source of the Thorium Disintegration Products Present in the Atmosphere: Bertram B. Boltwood.

The Presence of Lead in Autunite and Other Secondary Uranium Minerals: Bertram B. Boltwood.

The Capillarity of Mercury in the Presence of Vapors: Morris Loeb and Stephen R. Morey.

Determination of the Vapor Tension of Solutions by Means of the Morley-Brush Gauge: O. F. Tower.

B. E. Curry,
Press Secretary

Transmitted by Professor Chas. L. Parsons, *Secretary.*

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